

SEQUENCE LISTING

(1) GENERAL INFORMATION:

(i) APPLICANT:

- (A) NAME: National Starch and Chemical Investment Holding Corporation
- (B) STREET: 501 Silverside Road, Suite 27
- (C) CITY: Wilmington
- (D) STATE: Delaware
- (E) COUNTRY: United States of America
- (F) POSTAL CODE (ZIP): 19809

(ii) TITLE OF INVENTION: Improvements in or Relating to Plant Starch Composition

(iii) NUMBER OF SEQUENCES: 20

(iv) COMPUTER READABLE FORM:

- (A) MEDIUM TYPE: Floppy disk
- (B) COMPUTER: IBM PC compatible
- (C) OPERATING SYSTEM: PC-DOS/MS-DOS
- (D) SOFTWARE: PatentIn Release #1.0, Version #1.30 (EPO)

(2) INFORMATION FOR SEQ ID NO: 1:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 57 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 1:

AAGGATCCGT CGACATCGAT AATACGACTC ACTATAGGGA TTTTTTTTTT
TTTTTT 57

(2) INFORMATION FOR SEQ ID NO: 2:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 17 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 2:

AAGGATCCGT CGACATC

17

(2) INFORMATION FOR SEQ ID NO: 3:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 17 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 3:

GACATCGATA ATACGAC

17

(2) INFORMATION FOR SEQ ID NO: 4:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 20 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 4:

CATCCAACCA CCATCTCGCA

20

(2) INFORMATION FOR SEQ ID NO: 5:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 20 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 5:

TTGAGAGAAG ATACCTAAGT

20

(2) INFORMATION FOR SEQ ID NO: 6:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 20 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 6:

ATGTTTCAGTC CATCTAAAGT

20

(2) INFORMATION FOR SEQ ID NO: 7:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 20 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 7:

AGAACAACAA TTCCTAGCTC

20

(2) INFORMATION FOR SEQ ID NO: 8:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 20 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 8:

GGGGCCTTGA ACTCAGCAAT

20

(2) INFORMATION FOR SEQ ID NO: 9:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 20 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 9:

CGTCCCAGCA TTCGACATAA

20

(2) INFORMATION FOR SEQ ID NO: 10:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 26 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 10:

CTTGGATCCT TGAAGTCAGC AATTTG

26

(2) INFORMATION FOR SEQ ID NO: 11:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 29 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 11:

TAACTCGAGC AACGCGATCA CAAGTTCGT

29

(2) INFORMATION FOR SEQ ID NO: 12:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 3003 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 12:

GATGGGGCCT TGAAGTCAGC AATTTGACAC TCAGTTAGTT ACACTGCCAT
CACTTATCAG 60

ATCTCTATTT TTTCTCTTAA TTCCAACCAA GGAATGAATA AAAAGATAGA
TTTGTA AAAA 120

CCCTAAGGAG AGAAGAAGAA AGATGGTGTA TACACTCTCT GGAGTTCGTT
TTCCTACTGT 180

TCCATCAGTG TACAAATCTA ATGGATTCAG CAGTAATGGT GATCGGAGGA
ATGCTAATAT 240

20121014 10:54:50

TTCTGTATTC TTGAAAAAAC ACTCTCTTTC ACGGAAGATC TTGGCTGAAA
AGTCTTCTTA 300

CAATTCCGAA TCCCGACCTT CTACAATTGC AGCATCGGGG AAAGTCCTTG
TGCCTGGAAT 360

CCAGAGTGAT AGCTCCTCAT CCTCAACAGA TCAATTTGAG TTCGCTGAGA
CATCTCCAGA 420

AAATTCCCCA GCATCAACTG ATGTAGATAG TTCAACAATG GAACACGCTA
GCCAGATTAA 480

AACTGAGAAC GATGACGTTG AGCCGTCAAG TGATCTTACA
GGAAGTGTTG AAGAGCTGGA 540

TTTTGCTTCA TCACTACAAC TACAAGAAGG TGGTAAACTG GAGGAGTCTA
AAACATTA 600

TACTTCTGAA GAGACAATTA TTGATGAATC TGATAGGATC AGAGAGAGGG
GCATCCCTCC 660

ACCTGGACTT GGTGAGAAGA TTTATGAAAT AGACCCCCTT TTGACAACT
ATCGTCAACA 720

CCTTGATTAC AGGTATTCAC AGTACAAGAA ACTGAGGGAG GCAATTGACA
AGTATGAGGG 780

TGGTTTGGAA GCTTTTTCTC GTGGTTATGA AAGAATGGGT TTCACTCGTA
GTGCTACAGG 840

TATCACTTAC CGTGAGTGGG CTCCTGGTGC CCAGTCAGCT
GCCCTCATTG GGGATTTC 900

CAATTGGGAC GCAAATGCTG ACTTTATGAC TCGGAATGAA TTTGGTGTCT
GAGAGATTTT 960

TCTGCCAAAT AATGTGGATG GTTCTCCTGC AATTCCTCAT GGGTCCAGAG
TGAAGATACG 1020

TATGGACACT CCATCAGGTG TTAAGGATTC CATTCTGCT TGGATCAACT
ACTCTTTACA 1080

GCTTCCTGAT GAAATTCCAT ATAATGGAAT ATATTATGAT CCACCCGAAG
AGGAGAGGTA 1140

TATCTTCCAA CACCCACGGC CAAAGAAACC AAAGTCGGTG AGAATATATG
AATCTCATAT 1200

TGGAATGAGT AGTCCGGAGC CTAAAATTAA CTCATACGTG AATTTTAGAG
ATGAAGTTCT 1260

TCCTCGCATA AAAAAAGCTT GGGTACAATG CGGTGCAAAT TATGGCTATT
CAAGAGCATT 1320

CTTATTATGC TAGTTTTGGT TATCATGTCA CAAATTTTTT TGCACCAAGC
AGCCGTTTTG 1380

GAACGCCCGA CGACCTTAAG TCTTTGATTG ATAAAGCTCA TGAGCTAGGA
ATTGTTGTTC 1440

TCATGGACAT TGTTACACAGC CATGCATCAA ATAATACTTT AGATGGACTG
AACATGTTTG 1500

ACGGCACAGA TAGTTGTTAC TTCACTCTG GAGCTCGTGG TTATCATTGG
ATGTGGGATT 1560

TCCGCCTCTT TAACTATGGA AACTGGGAGG TACTTAGGTA TCTTCTCTCA
AATGCGAGAT 1620

GGTGGTTGGA TGAGTTCAAA TTTGATGGAT TTAGATTGA TGGTGTGACA
TCAATGATGT 1680

GTA CTCACCA CGGATTATCG GTGGGATTCA CTGGGAACTA
CGAGGAATAC TTTGGACTCG 1740

CAACTGATGT GGATGCTGTT GTGTATCTGA TGCTGGTCAA CGATCTTATT
CATGGGCTTT 1800

TCCCAGATGC AATTACCATT GGTGAAGATG TTAGCGGAAT GCCGACATTT
TGTGTTCCCG 1860

TTCAAGATGG GGGTGTTGGC TTTGACTATC GGCTGCATAT GGCAATTGCT
GATAAATGGA 1920

TTGAGTTGCT CAAGAAACGG GATGAGGATT GGAGAGTGGG
TGATATTGTT CATACACTGA 1980

CAAATAGAAG ATGGTCGGAA AAGTGTGTTT CATACGCTGA AAGTCATGAT
CAAGCTCTAG 2040

TCGGTGATAA AACTATAGCA TTCTGGCTGA TGGACAAGGA TATGTATGAT
TTTATGGCTC 2100

TGGATAGACC GTCAACATCA TTAATAGATC GTGGGATAGC ATTACACAAG
ATGATTAGGC 2160

TTGTAACAT GGGATTAGGA GGAGAAGGGT ACCTAAATTT CATGGGAAAT
GAATTCGGCC 2220

ACCCTGAGTG GATTGATTTC CCTAGGGCTG AACAACACCT CTCTGATGGC
TCAGTAATTC 2280

CCAGAAACCA ATTCAGTTAT GATAAATGCA GACGGAGATT TGACCTGGGA
GATGCAGAAT 2340

ATTTAAGATA CCGTGGGTTG CAAGAATTTG ACCGGGCTAT GCAGTATCTT
GAAGATAAAT 2400

ATGAGTTTAT GACTTCAGAA CACCAGTTCA TATCACGAAA GGATGAAGGA
GATAGGATGA 2460

TTGTATTTGA AAAAGGAAAC CTAGTTTTTG TCTTTAATTT TCACTGGACA
AAAGGCTATT 2520

CAGACTATCG CATAGGCTGC CTGAAGCCTG GAAAATACAA
GGTTGCCTTG GACTCAGATG 2580

ATCCACTTTT TGGTGGCTTC GGGAGAATTG ATCATAATGC CGAATATTTT
ACCTTTGAAG 2640

GATGGTATGA TGATCGTCCT CGTTCAATTA TGGTGTATGC ACCTAGTAGA
ACAGCAGTGG 2700

TCTATGCACT AGTAGACAAA GAAGAAGAAG AAGAAGAAGA AGTAGCAGTA
GTAGAAGAAG 2760

TAGTAGTAGA AGAAGAATGA ACGAACTTGT GATCGCGTTG AAAGATTTGA
ACGCCACATA 2820

GAGCTTCTTG ACGTATCTGG CAATATTGCA TTAGTCTTGG CGGAATTTCA
TGTGACAACA 2880

GGTTTGCAAT TCTTTCCACT ATTAGTAGTG CAACGATATA CGCAGAGATG
AAGTGCTGAA 2940

GATTTTGCTT CATCACTACA ACTACAAGAA GGTGGTAAAC TGGAGGAGTC
TAAACATTA 600

AATACTTCTG AAGAGACAAT TATTGATGAA TCTGATAGGA TCAGAGAGAG
GGGCATCCCT 660

CCACCTGGAC TTGGTCAGAA GATTTATGAA ATAGACCCCC TTTTGACAAA
CTATCGTCAA 720

CACCTTGATT ACAGGTATTC ACAGTACAAG AACTGAGGG AGGCAATTGA
CAAGTATGAG 780

GGTGGTTTGG AAGCTTTTCT CGTGGTTATG AAAAAATGGG TTCACTCGT
AGTGCTACAG 840

GTATCACTTA CCGTGAGTGG GCTCCTGGTG CCCAGTCAGC
TGCCCTCATT GGAGATTTC 900

ACAATTGGGA CGCAAATGCT GACATTATGA CTCGGAATGA ATTTGGTGTC
TGGGAGATT 960

TTCTGCCAAA TAATGTGGAT GGTTCCTCTG CAATTCCTCA TGGGTCCAGA
GTGAAGATAC 1020

GTATGGACAC TCCATCAGGT GTTAAGGATT CCATTCCTGC TTGGATCAAC
TACTCTTTAC 1080

AGCTTCCTGA TGAAATTCCA TATAATGGAA TATATTATGA TCCACCCGAA
GAGGAGAGGT 1140

ATATCTTCCA ACACCCACGG CCAAAGAAAC CAAAGTCGCT GAGAATATAT
GAATCTCATA 1200

TTGGAATGAG TAGTCCGGAG CCTAAAATTA ACTCATACGT GAATTTTAGA
GATGAAGTTC 1260

TTCTCGCAT AAAAAAGCTT GGTACAATG CGCTGCGAAT TATGGCTATT
CAAGAGCATT 1320

CTTATTATGC TAGTTTTGGT TATCATGTCA CAAATTTTTT TGCACCAAGC
AGCCGTTTTG 1380

GAACGCCCGA CGACCTTAAG TCTTCGATTG ATAAAGCTCA TGAGCTAGGA
ATTGTTGTTC 1440

TCATGGACAT CGTTCACAGC CATGCATCAA ATAATACTTT AGATGGACTG
AACATGTTTG 1500

ACGGCACCGA TAGTTGTTAC TTCACTCTG GAGCTCGTGG TTATCATTGG
ATGTGGGATT 1560

CCGCCTCTTT AACTATGGAA ACTGGGAGGT ACTTAGGTAT CTTCTCTCAA
ATGCGAGATG 1620

GTGGTTGGAT GAGTTCAAAT TTGATGGATT TAGATTCGAT GGTGTGACAT
CAATGATGTA 1680

TACTACCCAC GGATTATCGG TGGGATTCAC TGGGAACTAC GAGGAATACT
TTGGACTCGC 1740

AACTGATGTG GATGCTGTTG TGTATCTGAT GCTGGTCAAC GATCTTATTC
ATAGGCTTTT 1800

CCCAGATGCA ATTACCATTG GTGAAGATGT TAGCGGAATG CCGACATTTT
GTATTCCCGT 1860

TCAAGATGGG GGTGTTGGCT TTGACTATCG GCTGCATATG
GCAATTGCTG ATAAATGGAT 1920

TGAGTTGCTC AAGAAACGGG ATGAGGATTG GAGAGTGGGT
GATATTGTTC ATACACTGAC 1980

AAATAGAAGA TGGTCGGAAA AGTGTGTTTC ATACGCTGAA AGTCATGATC
AAGCTCTAGT 2040

CGGTGATAAA ACTATAGCAT TCTGGCTGAT GGACAAGGAT ATGTATGATT
TTATGGCTCT 2100

GGATAGACCG CCAACATCAT TAATAGATCG TGGGATAGCA TTGCACAAGA
TGATTAGGCT 2160

TGTA ACTATG GGATTAGGAG GAGAAGGGTA CCTAAATTTC ATGGGAAATG
AATTCGGCCA 2220

CCCTGAGTGG ATTGATTTCC CTAGGGCTGA GCCACACCTT TCTGATGGCT
CAGTAATTCC 2280

CGGAAACCAA TTCAGTTATG ATAAATGCAG ACGGAGATTT
GACCTGGGAG ATGCAGAATA 2340

TTTAAGATAC CATGGGTTAC AAGAATTTGA CTGGGCTATG CAGTATCTTG
AAGATAAATA 2400

TGAGTTTATG ACTTCAGAAC ACCAGTTCAT ATCACGAAAG GATGAAGGAG
ATAGGATGAT 2460

TGTATTTGAA AGAGGAAACC TAGTTTTCGT CTTTAATTTT CACTGGACAA
ATAGCTATTC 2520

AGACTATCGC ATAGGCTGCC TGAAGCCTGG AAAATACAAG
GTTGTCTTGG ACTCAGATGA 2580

TCCACTTTTT GGTGGCTTCG GGAGAATTGA TCATAATGCC GAATATTTCA
CCTCTGAAGG 2640

ATCGTATGAT GATCGTCCTT GTTCAATTAT GGTGTATGCA CCTAGTAGAA
CAGCAGTGGT 2700

CTATGCACTA GTAGACAAAC TAGAAGTAGC AGTAGTAGAA GAACCCATTG
AAGAATGAAC 2760

GAACTTGTGA TCGCGTTGAA AGATTTGAAC GTTACTTGGT CATCCACATA
GAGCTTCTTG 2820

ACATCAGTCT TGGCGGAATT GCATGTGACA ACAAGGTTTG CAGTTCTTTC
CACTATTAGT 2880

AGTCCACCGA TATACGCAGA GATGAAGTGC TGAACAAACA TATGTAAAAT
CGATGAATTT 2940

ATGTCGAATG CTGGGACGAT CGAATTCCTG CAGCC
2975

(2) INFORMATION FOR SEQ ID NO: 14:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 3033 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ix) FEATURE:

- (A) NAME/KEY: CDS
- (B) LOCATION:145..2790

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 14:

TTGATGGGGC CTTGAACTCA GCAATTTGAC ACTCAGTTAG TTACACTCCT
ATCACTTATC 60

AGATCTCTAT TTTTCTCTT AATTCCAACC AAGGAATGAA TAAAAGGATA
GATTTGTAAA 120

AACCCTAAGG AGAGAAGAAG AAAG ATG GTG TAT ACA CTC TCT GGA
GTT CGT 171

Met Val Tyr Thr Leu Ser Gly Val Arg
1 5

TTT CCT ACT GTT CCA TCA GTG TAC AAA TCT AAT GGA TTC AGC AGT
AAT 219

Phe Pro Thr Val Pro Ser Val Tyr Lys Ser Asn Gly Phe Ser Ser Asn
10 15 20 25

GGT GAT CGG AGG AAT GCT AAT GTT TCT GTA TTC TTG AAA AAG CAC
TCT 267

Gly Asp Arg Arg Asn Ala Asn Val Ser Val Phe Leu Lys Lys His Ser
30 35 40

CTT TCA CGG AAG ATC TTG GCT GAA AAG TCT TCT TAC AAT TCC GAA
TTC 315

Leu Ser Arg Lys Ile Leu Ala Glu Lys Ser Ser Tyr Asn Ser Glu Phe
45 50 55

CGA CCT TCT ACA GTT GCA GCA TCG GGG AAA GTC CTT GTG CCT GGA
ACC 363

Arg Pro Ser Thr Val Ala Ala Ser Gly Lys Val Leu Val Pro Gly Thr
60 65 70

CAG AGT GAT AGC TCC TCA TCC TCA ACA GAC CAA TTT GAG TTC ACT
GAG 411

Gln Ser Asp Ser Ser Ser Ser Ser Thr Asp Gln Phe Glu Phe Thr Glu
75 80 85

ACA TCT CCA GAA AAT TCC CCA GCA TCA ACT GAT GTA GAT AGT TCA
ACA 459

Thr Ser Pro Glu Asn Ser Pro Ala Ser Thr Asp Val Asp Ser Ser Thr
90 95 100 105

GGA GAT TTC AAC AAT TGG GAC GCA AAT GCT GAC ATT ATG ACT CGG
AAT 939
Gly Asp Phe Asn Asn Trp Asp Ala Asn Ala Asp Ile Met Thr Arg Asn
250 255 260 265

GAA TTT GGT GTC TGG GAG ATT TTT CTG CCA AAT AAT GTG GAT GGT
TCT 987
Glu Phe Gly Val Trp Glu Ile Phe Leu Pro Asn Asn Val Asp Gly Ser
270 275 280

CCT GCA ATT CCT CAT GGG TCC AGA GTG AAG ATA CGT ATG GAC ACT
CCA 1035
Pro Ala Ile Pro His Gly Ser Arg Val Lys Ile Arg Met Asp Thr Pro
285 290 295

TCA GGT GTT AAG GAT TCC ATT CCT GCT TGG ATC AAC TAC TCT TTA
CAG 1083
Ser Gly Val Lys Asp Ser Ile Pro Ala Trp Ile Asn Tyr Ser Leu Gln
300 305 310

CTT CCT GAT GAA ATT CCA TAT AAT GGA ATA CAT TAT GAT CCA CCC
GAA 1131
Leu Pro Asp Glu Ile Pro Tyr Asn Gly Ile His Tyr Asp Pro Pro Glu
315 320 325

GAG GAG AGG TAT ATC TTC CAA CAC CCA CGG CCA AAG AAA CCA AAG
TCG 1179
Glu Glu Arg Tyr Ile Phe Gln His Pro Arg Pro Lys Lys Pro Lys Ser
330 335 340 345

CTG AGA ATA TAT GAA TCT CAT ATT GGA ATG AGT AGT CCG GAG CCT
AAA 1227
Leu Arg Ile Tyr Glu Ser His Ile Gly Met Ser Ser Pro Glu Pro Lys
350 355 360

ATT AAC TCA TAC GTG AAT TTT AGA GAT GAA GTT CTT CCT CGC ATA
AAA 1275
Ile Asn Ser Tyr Val Asn Phe Arg Asp Glu Val Leu Pro Arg Ile Lys
365 370 375

AAG CTT GGG TAC AAT GCG CTG CAA ATT ATG GCT ATT CAA GAG CAT
TCT 1323
Lys Leu Gly Tyr Asn Ala Leu Gln Ile Met Ala Ile Gln Glu His Ser
380 385 390

20250401 14:54:01

TAT TAC GCT AGT TTT GGT TAT CAT GTC ACA AAT TTT TTT GCA CCA
AGC 1371
Tyr Tyr Ala Ser Phe Gly Tyr His Val Thr Asn Phe Phe Ala Pro Ser
395 400 405

AGC CGT TTT GGA ACG CCC GAC GAC CTT AAG TCT TTG ATT GAT AAA
GCT 1419
Ser Arg Phe Gly Thr Pro Asp Asp Leu Lys Ser Leu Ile Asp Lys Ala
410 415 420 425

CAT GAG CTA GGA ATT GTT GTT CTC ATG GAC ATT GTT CAC AGC CAT
GCA 1467
His Glu Leu Gly Ile Val Val Leu Met Asp Ile Val His Ser His Ala
430 435 440

TCA AAT AAT ACT TTA GAT GGA CTG AAC ATG TTT GAC TGC ACC GAT
AGT 1515
Ser Asn Asn Thr Leu Asp Gly Leu Asn Met Phe Asp Cys Thr Asp Ser
445 450 455

TGT TAC TTT CAC TCT GGA GCT CGT GGT TAT CAT TGG ATG TGG GAT
TCC 1563
Cys Tyr Phe His Ser Gly Ala Arg Gly Tyr His Trp Met Trp Asp Ser
460 465 470

CGC CTC TTT AAC TAT GGA AAC TGG GAG GTA CTT AGG TAT CTT CTC
TCA 1611
Arg Leu Phe Asn Tyr Gly Asn Trp Glu Val Leu Arg Tyr Leu Leu Ser
475 480 485

AAT GCG AGA TGG TGG TTG GAT GCG TTC AAA TTT GAT GGA TTT AGA
TTT 1659
Asn Ala Arg Trp Trp Leu Asp Ala Phe Lys Phe Asp Gly Phe Arg Phe
490 495 500 505

GAT GGT GTG ACA TCA ATG ATG TAT ATT CAC CAC GGA TTA TCG GTG
GGA 1707
Asp Gly Val Thr Ser Met Met Tyr Ile His His Gly Leu Ser Val Gly
510 515 520

TTC ACT GGG AAC TAC GAG GAA TAC TTT GGA CTC GCA ACT GAT GTG
GAT 1755
Phe Thr Gly Asn Tyr Glu Glu Tyr Phe Gly Leu Ala Thr Asp Val Asp
525 530 535

GCT GTT GTG TAT CTG ATG CTG GTC AAC GAT CTT ATT CAT GGG CTT
TTC 1803
Ala Val Val Tyr Leu Met Leu Val Asn Asp Leu Ile His Gly Leu Phe
540 545 550

CCA GAT GCA ATT ACC ATT GGT GAA GAT GTT AGC GGA ATG CCG ACA
TTT 1851
Pro Asp Ala Ile Thr Ile Gly Glu Asp Val Ser Gly Met Pro Thr Phe
555 560 565

TGT ATT CCC GTC CAA GAG GGG GGT GTT GGC TTT GAC TAT CGG CTG
CAT 1899
Cys Ile Pro Val Gln Glu Gly Gly Val Gly Phe Asp Tyr Arg Leu His
570 575 580 585

ATG GCA ATT GCT GAT AAA CGG ATT GAG TTG CTC AAG AAA CGG GAT
GAG 1947
Met Ala Ile Ala Asp Lys Arg Ile Glu Leu Leu Lys Lys Arg Asp Glu
590 595 600

GAT TGG AGA GTG GGT GAT ATT GTT CAT ACA CTG ACA AAT AGA AGA
TGG 1995
Asp Trp Arg Val Gly Asp Ile Val His Thr Leu Thr Asn Arg Arg Trp
605 610 615

TCG GAA AAG TGT GTT TCA TAC GCT GAA AGT CAT GAT CAA GCT CTA
GTC 2043
Ser Glu Lys Cys Val Ser Tyr Ala Glu Ser His Asp Gln Ala Leu Val
620 625 630

GGT GAT AAA ACT ATA GCA TTC TGG CTG ATG GAC AAG GAT ATG TAT
GAT 2091
Gly Asp Lys Thr Ile Ala Phe Trp Leu Met Asp Lys Asp Met Tyr Asp
635 640 645

TTT ATG GCT CTG GAT AGA CCG TCA ACA TCA TTA ATA GAT CGT GGG
ATA 2139
Phe Met Ala Leu Asp Arg Pro Ser Thr Ser Leu Ile Asp Arg Gly Ile
650 655 660 665

GCA TTG CAC AAG ATG ATT AGG CTT GTA ACT ATG GGA TTA GGA GGA
GAA 2187
Ala Leu His Lys Met Ile Arg Leu Val Thr Met Gly Leu Gly Gly Glu
670 675 680

GGG TAC CTA AAT TTC ATG GGA AAT GAA TTC GGC CAC CCT GAG TGG
ATT 2235
Gly Tyr Leu Asn Phe Met Gly Asn Glu Phe Gly His Pro Glu Trp Ile
685 690 695

GAT TTC CCT AGG GCT GAA CAA CAC CTC TCT GAT GGC TCA GTA ATC
CCC 2283
Asp Phe Pro Arg Ala Glu Gln His Leu Ser Asp Gly Ser Val Ile Pro
700 705 710

GGA AAC CAA TTC AGT TAT GAT AAA TGC AGA CGG AGA TTT GAC CTG
GGA 2331
Gly Asn Gln Phe Ser Tyr Asp Lys Cys Arg Arg Arg Phe Asp Leu Gly
715 720 725

GAT GCA GAA TAT TTA AGA TAC CGT GGG TTG CAA GAA TTT GAC CGG
CCT 2379
Asp Ala Glu Tyr Leu Arg Tyr Arg Gly Leu Gln Glu Phe Asp Arg Pro
730 735 740 745

ATG CAG TAT CTT GAA GAT AAA TAT GAG TTT ATG ACT TCA GAA CAC
CAG 2427
Met Gln Tyr Leu Glu Asp Lys Tyr Glu Phe Met Thr Ser Glu His Gln
750 755 760

TTC ATA TCA CGA AAG GAT GAA GGA GAT AGG ATG ATT GTA TTT GAA
AAA 2475
Phe Ile Ser Arg Lys Asp Glu Gly Asp Arg Met Ile Val Phe Glu Lys
765 770 775

GGA AAC CTA GTT TTT GTC TTT AAT TTT CAC TGG ACA AAA AGC TAT
TCA 2523
Gly Asn Leu Val Phe Val Phe Asn Phe His Trp Thr Lys Ser Tyr Ser
780 785 790

GAC TAT CGC ATA GCC TGC CTG AAG CCT GGA AAA TAC AAG GTT GCC
TTG 2571
Asp Tyr Arg Ile Ala Cys Leu Lys Pro Gly Lys Tyr Lys Val Ala Leu
795 800 805

GAC TCA GAT GAT CCA CTT TTT GGT GGC TTC GGG AGA ATT GAT CAT
AAT 2619
Asp Ser Asp Asp Pro Leu Phe Gly Gly Phe Gly Arg Ile Asp His Asn
810 815 820 825

GCC GAA TAT TTC ACC TTT GAA GGA TGG TAT GAT GAT CGT CCT CGT
TCA 2667

Ala Glu Tyr Phe Thr Phe Glu Gly Trp Tyr Asp Asp Arg Pro Arg Ser
830 835 840

ATT ATG GTG TAT GCA CCT TGT AAA ACA GCA GTG GTC TAT GCA CTA
GTA 2715

Ile Met Val Tyr Ala Pro Cys Lys Thr Ala Val Val Tyr Ala Leu Val
845 850 855

GAC AAA GAA GAA GAA GAA GAA GAA GAA GAA GAA GAA GAA GTA GCA
GCA 2763

Asp Lys Glu Glu Glu Glu Glu Glu Glu Glu Glu Glu Val Ala Ala
860 865 870

GTA GAA GAA GTA GTA GTA GAA GAA GAA TGAACGAACT TGTGATCGCG
2810

Val Glu Glu Val Val Val Glu Glu Glu
875 880

TTGAAAGATT TGAACGCTAC ATAGAGCTTC TTGACGTATC TGGCAATATT
GCATCAGTCT 2870

TGGCGGAATT TCATGTGACA CAAGGTTTGC AATTCTTTCC ACTATTAGTA
GTGCAACGAT 2930

ATACGCAGAG ATGAAGTGCT GAACAAACAT ATGTAAAATC GATGAATTTA
TGTCGAATGC 2990

TGGGACGATC GAATTCCTGC AGGCCGGGGG ACCCCTTAGT TCT
3033

(2) INFORMATION FOR SEQ ID NO: 15:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 882 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 15:

Met Val Tyr Thr Leu Ser Gly Val Arg Phe Pro Thr Val Pro Ser Val
1 5 10 15

10564501

Tyr Lys Ser Asn Gly Phe Ser Ser Asn Gly Asp Arg Arg Asn Ala Asn
20 25 30

Val Ser Val Phe Leu Lys Lys His Ser Leu Ser Arg Lys Ile Leu Ala
35 40 45

Glu Lys Ser Ser Tyr Asn Ser Glu Phe Arg Pro Ser Thr Val Ala Ala
50 55 60

Ser Gly Lys Val Leu Val Pro Gly Thr Gln Ser Asp Ser Ser Ser Ser
65 70 75 80

Ser Thr Asp Gln Phe Glu Phe Thr Glu Thr Ser Pro Glu Asn Ser Pro
85 90 95

Ala Ser Thr Asp Val Asp Ser Ser Thr Met Glu His Ala Ser Gln Ile
100 105 110

Lys Thr Glu Asn Asp Asp Val Glu Pro Ser Ser Asp Leu Thr Gly Ser
115 120 125

Val Glu Glu Leu Asp Phe Ala Ser Ser Leu Gln Leu Gln Glu Gly Gly
130 135 140

Lys Leu Glu Glu Ser Lys Thr Leu Asn Thr Ser Glu Glu Thr Ile Ile
145 150 155 160

Asp Glu Ser Asp Arg Ile Arg Glu Arg Gly Ile Pro Pro Pro Gly Leu
165 170 175

Gly Gln Lys Ile Tyr Glu Ile Asp Pro Leu Leu Thr Asn Tyr Arg Gln
180 185 190

His Leu Asp Tyr Arg Tyr Ser Gln Tyr Lys Lys Leu Arg Glu Ala Ile
195 200 205

Asp Lys Tyr Glu Gly Gly Leu Glu Ala Phe Ser Arg Gly Tyr Glu Lys
210 215 220

Met Gly Phe Thr Arg Ser Ala Thr Gly Ile Thr Tyr Arg Glu Trp Ala
225 230 235 240

Leu Gly Ala Gln Ser Ala Ala Leu Ile Gly Asp Phe Asn Asn Trp Asp
245 250 255

Ala Asn Ala Asp Ile Met Thr Arg Asn Glu Phe Gly Val Trp Glu Ile

260 265 270
 Phe Leu Pro Asn Asn Val Asp Gly Ser Pro Ala Ile Pro His Gly Ser
 275 280 285
 Arg Val Lys Ile Arg Met Asp Thr Pro Ser Gly Val Lys Asp Ser Ile
 290 295 300
 Pro Ala Trp Ile Asn Tyr Ser Leu Gln Leu Pro Asp Glu Ile Pro Tyr
 305 310 315 320
 Asn Gly Ile His Tyr Asp Pro Pro Glu Glu Glu Arg Tyr Ile Phe Gln
 325 330 335
 His Pro Arg Pro Lys Lys Pro Lys Ser Leu Arg Ile Tyr Glu Ser His
 340 345 350
 Ile Gly Met Ser Ser Pro Glu Pro Lys Ile Asn Ser Tyr Val Asn Phe
 355 360 365
 Arg Asp Glu Val Leu Pro Arg Ile Lys Lys Leu Gly Tyr Asn Ala Leu
 370 375 380
 Gln Ile Met Ala Ile Gln Glu His Ser Tyr Tyr Ala Ser Phe Gly Tyr
 385 390 395 400
 His Val Thr Asn Phe Phe Ala Pro Ser Ser Arg Phe Gly Thr Pro Asp
 405 410 415
 Asp Leu Lys Ser Leu Ile Asp Lys Ala His Glu Leu Gly Ile Val Val
 420 425 430
 Leu Met Asp Ile Val His Ser His Ala Ser Asn Asn Thr Leu Asp Gly
 435 440 445
 Leu Asn Met Phe Asp Cys Thr Asp Ser Cys Tyr Phe His Ser Gly Ala
 450 455 460
 Arg Gly Tyr His Trp Met Trp Asp Ser Arg Leu Phe Asn Tyr Gly Asn
 465 470 475 480
 Trp Glu Val Leu Arg Tyr Leu Leu Ser Asn Ala Arg Trp Trp Leu Asp
 485 490 495
 Ala Phe Lys Phe Asp Gly Phe Arg Phe Asp Gly Val Thr Ser Met Met
 500 505 510

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Tyr Ile His His Gly Leu Ser Val Gly Phe Thr Gly Asn Tyr Glu Glu
515 520 525

Tyr Phe Gly Leu Ala Thr Asp Val Asp Ala Val Val Tyr Leu Met Leu
530 535 540

Val Asn Asp Leu Ile His Gly Leu Phe Pro Asp Ala Ile Thr Ile Gly
545 550 555 560

Glu Asp Val Ser Gly Met Pro Thr Phe Cys Ile Pro Val Gln Glu Gly
565 570 575

Gly Val Gly Phe Asp Tyr Arg Leu His Met Ala Ile Ala Asp Lys Arg
580 585 590

Ile Glu Leu Leu Lys Lys Arg Asp Glu Asp Trp Arg Val Gly Asp Ile
595 600 605

Val His Thr Leu Thr Asn Arg Arg Trp Ser Glu Lys Cys Val Ser Tyr
610 615 620

Ala Glu Ser His Asp Gln Ala Leu Val Gly Asp Lys Thr Ile Ala Phe
625 630 635 640

Trp Leu Met Asp Lys Asp Met Tyr Asp Phe Met Ala Leu Asp Arg Pro
645 650 655

Ser Thr Ser Leu Ile Asp Arg Gly Ile Ala Leu His Lys Met Ile Arg
660 665 670

Leu Val Thr Met Gly Leu Gly Gly Glu Gly Tyr Leu Asn Phe Met Gly
675 680 685

Asn Glu Phe Gly His Pro Glu Trp Ile Asp Phe Pro Arg Ala Glu Gln
690 695 700

His Leu Ser Asp Gly Ser Val Ile Pro Gly Asn Gln Phe Ser Tyr Asp
705 710 715 720

Lys Cys Arg Arg Arg Phe Asp Leu Gly Asp Ala Glu Tyr Leu Arg Tyr
725 730 735

Arg Gly Leu Gln Glu Phe Asp Arg Pro Met Gln Tyr Leu Glu Asp Lys
740 745 750

Tyr Glu Phe Met Thr Ser Glu His Gln Phe Ile Ser Arg Lys Asp Glu
755 760 765

Gly Asp Arg Met Ile Val Phe Glu Lys Gly Asn Leu Val Phe Val Phe
770 775 780

Asn Phe His Trp Thr Lys Ser Tyr Ser Asp Tyr Arg Ile Ala Cys Leu
785 790 795 800

Lys Pro Gly Lys Tyr Lys Val Ala Leu Asp Ser Asp Asp Pro Leu Phe
805 810 815

Gly Gly Phe Gly Arg Ile Asp His Asn Ala Glu Tyr Phe Thr Phe Glu
820 825 830

Gly Trp Tyr Asp Asp Arg Pro Arg Ser Ile Met Val Tyr Ala Pro Cys
835 840 845

Lys Thr Ala Val Val Tyr Ala Leu Val Asp Lys Glu Glu Glu Glu Glu
850 855 860

Glu Glu Glu Glu Glu Glu Val Ala Ala Val Glu Glu Val Val Val Glu
865 870 875 880

Glu Glu

(2) INFORMATION FOR SEQ ID NO: 16:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2576 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 16:

TCATTAAAGA GGAGAAATTA ACTATGAGAG GATCTCACCA TCACCATCAC
CATGGGATCT 60

TGGCTGAAAA GTCTTCTTAC AATTCCGAAT TCCGACCTTC TACAGTTGCA
GCATCGGGGA 120

AAGTCCTTGT GCCTGGAACC CAGAGTGATA GCTCCTCATC CTCAACAAAC
CAATTTGAGT 180

TCACTGAGAC ATCTCCAGAA AATTCCCCAG CATCAACTGA TGTAGATAGT
TCAACAATGG 240

AACACGCTAG CCAGATTAAA ACTGAGAACG ATGACGTTGA
GCCGTCAAGT GATCTTACAG 300

GAAGTGTTGA AGAGCTGGAT TTTGCTTCAT CACTACAACT ACAAGAAGGT
GGTAAACTGG 360

AGGAGTCTAA AACATTAAAT ACTTCTGAAG AGACAATTAT TGATGAATCT
GATAGGATCA 420

GAGAGAGGGG CATCCCTCCA CCTGGACTTG GTCAGAAGAT
TTATGAAATA GACCCCCTTT 480

TGACAAACTA TCGTCAACAC CTTGATTACA GGTATTCACA GTACAAGAAA
CTGAGGGAGG 540

CAATTGACAA GTATGAGGGT GGTTTGGAAG CTTTTTCTCG TGGTTATGAA
AAAATGGGTT 600

TCACTCGTAG TGCTACAGGT ATCACTTACC GTGAGTGGGC
TCCTGGTGCC CAGTCAGCTG 660

CCCTCATTGG AGATTTCAAC AATTGGGACG CAAATGCTGA CATTATGACT
CGGAATGAAT 720

TTGGTGTCTG GGAGATTTTT CTGCCAAATA ATGTGGATGG TTCTCCTGCA
ATTCCTCATG 780

GGTCCAGAGT GAAGATACGT ATGGACACTC CATCAGGTGT
TAAGGATTCC ATCCTGCTT 840

GGATCAACTA CTCTACAGCT TCCTGATGAA ATTCCATATA ATGGAATATA
TTATGATCCA 900

CCCGAAGAGG AGAGGTATAT CTTCCAACAC CCACGGCCAA
AGAAACCAAA GTCGCTGAGA 960

ATATATGAAT CTCATATTGG AATGAGTAGT CCGGAGCCTA AAATTAATC
ATACGTGAAT 1020

TTTAGAGATG AAGTTCTTCC TCGCATAAAA AAGCTTGGGT ACAATGCGCT
GCAAATTATG 1080

GCTATTCAAG AGCATTCTTA TTATGCTAGT TTTGGTTATC ATGTCACAAA
TTTTTTTGCA 1140

CCAAGCAGCC GTTTTGGAAC GCCCGACGAC CTTAAGTCTT TGATTGATAA
AGCTCATGAG 1200

CTAGGAATTG TTGTTCTCAT GGACATTGTT CACAGCCATG CATCAAATAA
TACTTTAGAT 1260

GGACTGAACA TGTTTGACGG CACCGATAGT TGTTACTTTC ACTCTGGAGC
TCGTGGTTAT 1320

CATTGGATGT GGGATTCCCG CCTTTTAAAC TATGGAAACT GGGAGGTACT
TAGGTATCTT 1380

CTCTCAAATG CGAGATGGTG GTTGGATGAG TTCAAATTTG ATGGATTTAG
ATTTGATGGT 1440

GTGACATCAA TGATGTATAC TCACCACGGA TTATCGGTGG GATTCACTGG
GAACTACGAG 1500

GAATACTTTG GACTCGCAAC TGATGTGGAT GCTGTTGTGT ATCTGATGCT
GGTCAACGAT 1560

CTTATTCATG GGCTTTTCCC AGATGCAATT ACCATTGGTG AAGATGTTAG
CGGAATGCCG 1620

ACATTTTGTA TTCCCGTTCA AGATGGGGGT GTTGGCTTTG ACTATCGGCT
GCATATGGCA 1680

ATTGCTGATA AATGGATTGA GTTGCTCAAG AAACGGGATG
AGGATTGGAG AGTGGGTGAT 1740

ATTGTTTATA CACTGACAAA TAGAAGATGG TCGGAAAAGT GTGTTTCATA
CGCTGAAAGT 1800

CATGATCAAG CTCTAGTCGG TGATAAACT ATAGCATTCT GGCTGATGGA
CAAGGATATG 1860

TATGATTTTA TGGCTCTGGA TAGACCGCCA ACATCATTA TAGATCGTGG
GATAGCATTG 1920

CACAAGATGA TTAGGCTTGT AACTATGGGA TTAGGAGGAG
AAGGGTACCT AAATTTTCATG 1980

GGAAATGAAT TCGGCCACCC TGAGTGGATT GATTTCCCTA
GGGCTGAACA ACACCTCTCT 2040

GATGACTCAG TAATTCCCGG AAACCAATTC AGTTATGATA AATGCAGACG
GAGATTTGAC 2100

CTGGGAGATG CAGAATATTT AAGATACCGT GGGTTGCAAG AATTTGACCG
GGCTATGCAG 2160

TATCTTGAAG ATAAATATGA GTTTATGACT TCAGAACACC AGTTCATATC
ACGAAAGGAT 2220

GAAGGAGATA GGATGATTGT ATTTGAAAAA GGAAACCTAG TTTTGTCTT
TAATTTTCAC 2280

TGGACAAAAA GCTATTCAGA CTATCGCATA GGCTGCCTGA AGCCTGGAAA
ATACAAGGTT 2340

GCCTTGGACT CAGATGATCC ACTTTTGGT GGCTTCGGGA GAATTGATCA
TAATGCCGAA 2400

TATTTACCT TTGAAGGATG GTATGATGAT CGTCCTCGTT CAATTATGGT
GTATGCACCT 2460

TGTAGAACAG CAGTGGTCTA TGCACCTAGTA GACAAAGAAG
AAGAAGAAGA AGAAGAAGAA 2520

GAAGAAGTAG CAGTAGTAGA AGAAGTAGTA GTAGAAGAAG
AATGAACGAA CTTGTG 2576

(2) INFORMATION FOR SEQ ID NO: 17:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2529 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 17:

GGATGCTAAT GTTTCTGTAT TCTTGAAAAA GCACTCTCTT TCACGGAAGA
TCTTGGCTGA 60

AAAGTCTTCT TACAATTCCG AATCCCGACC TTCTACAGTT GCAGCATCGG
GGAAAGTCCT 120

TGTGCCTGGA AYCCAGAGTG ATAGCTCCTC ATCCTCAACA GACCAATTTG
AGTTCACTGA 180

GACATCTCCA GAAAATTCCC CAGCATCAAC TGATGTAGAT AGTTCAACAA
TGGAACACGC 240

TAGCCAGATT AAAACTGAGA ACGATGACGT TGAGCCGTCA AGTGATCTTA
CAGGAAGTGT 300

TGAAGAGCTG GATTTTGCTT CATCACTACA ACTACAAGAA GGTGGTAAAC
TGGAGGAGTC 360

TAAACATTA AATACTTCTG AAGAGACAAT TATTGATGAA TCTGATAGGA
TCAGAGAGAG 420

GGGCATCCCT CCACCTGGAC TTGGTCAGAA GATTTATGAA
ATAGACCCCC TTTTGACAAA 480

CTATCGTCAA CACCTTGATT ACAGGTATTC ACAGTACAAG AAACTGAGGG
AGGCAATTGA 540

CAAGTATGAG GGTGGTTTGG AAGCTTTTTC TCGTGGTTAT GAAAAAATGG
GTTTCACTCG 600

TAGTGCTACA GGTATCACTT ACCGTGAGTG GGCTCCTGGT
GCCCAGTCAG CTGCCCTCAT 660

TGGAGATTTT AACAATTGGG ACGCAAATGC TGACATTATG ACTCGGAATG
AATTTGGTGT 720

CTGGGAGATT TTTCTGCCAA ATAATGTGGA TGGTTCTCCT GCAATTCCTC
ATGGGTCCAG 780

AGTGAAGATA CGYATGGACA CTCCATCAGG TGTTAAGGAT TCCATTCCTG
CTTGGATCAA 840

CTACTCTTTA CAGCTTCCTG ATGAAATTCC ATATAATGGA ATATATTATG
ATCCACCCGA 900

AGAGGAGAGG TATRTCTTCC AACACCCACG GCCAAAGAAA
CCAAAGTCGC TGAGAATATA 960

TGAATCTCAT ATTGGAATGA GTAGTCCGGA GCCTAAAATT AACTCATACG
TGAATTTTAG 1020

AGATGAAGTT CTTCTCGCA TAAAAASCT TGGGTACAAT GCGGTGCAAA
TTATGGCTAT 1080

TCAAGAGCAT TCTTATTATG CTAGTTTTGG TTATCATGTC ACAAATTTTT
TTGCACCAAG 1140

CAGCCGTTTT GGAACGCCCCG ACGACCTTAA GTCTTTGATT GATAAAGCTC
ATGAGCTAGG 1200

AATTGTTGTT CTCATGGACA TTGTTACAG CCATGCATCA AATAACTT
TAGATGGACT 1260

GAACATGTTT GACGGCACAG ATAGTTGTTA CTTTCACTCT GGAGCTCGTG
GTTATCATTG 1320

GATGTGGGAT TCCCGCCTCT TTAACATG AACTGGGAG GTACTTAGGT
ATCTTCTCTC 1380

AAATGCGAGA TGGTGGTTGG ATGAGTTCAA ATTTGATGGA TTTAGATTTG
ATGGTGTGAC 1440

ATCAATGATG TATACTCACC ACGGATTATC GGTGGGATTC ACTGGGAACT
ACGAGGAATA 1500

CTTTGGACTC GCAACTGATG TGGATGCTGT TGTGTATCTG ATGCTGGTCA
ACGATCTTAT 1560

TCACGGGCTT TTCCCAGATG CAATTACCAT TGGTGAAGAT GTTAGCGGAA
TGCCGACATT 1620

TTGTATTCCC GTTCAAGATG GGGGTGTTGG CTTTGAATAT CGGCTGCATA
TGGAATTGC 1680

TGATAAATGG ATTGAGTTGC TCAAGAAACG GGATGAGGAT
TGGAGAGTGG GTGATATTGT 1740

TCATACACTG ACAAATAGAA GATGGTCGGA AAAGTGTGTT TCATMCGCTG
AAAGTCATGA 1800

TCAAGCTCTA GTCGGTGATA AAACCTATAGC ATYCTGGCTG ATGGACAAGG
ATATGTATGA 1860

TTTTATGGCT CTGGATAGAC CGYCAACAYC ATTAATAGAT CGTGGGATAG
CATTGCACAA 1920

GATGATTAGG CTTGTAACTA TGGGATTAGG AGGAGAAGGG TACCTAAATT
TCATGGGAAA 1980

TGAATTCGGC CACCCTGAGT GGATTGATTT CCCTAGGGCT
GARCAACACC TCTCTGATGG 2040

CTCAGTAATT CCCGGAAACC AATTCAGTTA TGATAAATGC AGACGGAGAT
TTGACCTGGG 2100

AGATGCAGAA TATTTAAGAT ACCATGGGTT GCAAGAATTT GACCGGGCTA
TGCAGTATCT 2160

TGAAGATAAA TATGAGTTTA TGACTTCAGA ACACCAGTTC ATATCACGAA
AGGATGAAGG 2220

AGATAGGATG ATTGTATTTG AAARAGGAAA CCTAGTTTTT GTCTTTAATT
TTCCTGGAC 2280

AAATAGCTAT TCAGACTATC GCATAGGCTG CCTGAAGCCT GGAAAATACA
AGGTTGGCTT 2340

GGAATCAGAT GATCCACTTT TTGGTGGCTT CGGGAGAATT GATCATAATG
CCGAATATTT 2400

CACCTCTGAA GGATCGTATG ATGATCGTCC TCGTTCAATT ATGGTGTATG
CACCTAGTAG 2460

AACAGCAGTG GTCTATGCAC TAGTAGACAA ANTAGAAGNA
GAAGAAGAAG AAGAANCCGN 2520

NGAAGAATT

2529

(2) INFORMATION FOR SEQ ID NO: 18:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 3231 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 18:

GATTTAATAC GACTCACTAT AGGGATTTTT TTTTTTTTTT TTTTAAAAAC
CTCCTCCACT 60

CAGTCTTGGG ATCTCTCTCT CTCTTCACGC TTCTCTTGGG GCCTTGAAC
CAGCAATTTG 120

AACTCAGTT AGTTACACTC CTATCACTCA TCAGATCTCT ATTTTTTCTC
TTAATTCCAA 180

CCAAGGAATG AATTAAAAGA TTAGATTTGA AGGAGAGAAG AAGAAAGATG
GTGTATACAC 240

TCTCTGGAGT TCGTTTTCTT ACTGTTCCAT CAGTGTACAA ATCTAATGGA
TTCAGCAGTA 300

ATGGTGATCG GAGGAATGCT AATGTTTCTG TATTCTTGAA AAAGCACTCT
CTTTCACGGA 360

AGATCTTGGC TGAAAAGTCT TCTTACGATT CCGAATCCCG ACCTTCTACA
GTTGCAGCAT 420

CGGGGAAAGT CTTGTACCT GGAATCCAGA GTGATAGCTC
CTCATCCTCA ACAGACCAAT 480

TTGAGTTCAC TGAGACAGCT CCAGAAAATT CCCAGCATC AACTGATGTG
GATAGTTCAA 540

CAATGGAACA CGCTAGCCAG ATTA AAACTG AGAACGATGA
CGTTGAGCCG TCAAGTGATC 600

TTACAGGAAG TGTTGAAGAG TTGGATTTTG CTTCACTACT ACAACTACAA
GAAGGTGGTA 660

AACTGGAGGA GTCTAAAACA TTAAATACTT CTGAAGAGAC AATTATTGAT
GAATCTGATA 720

GGATCAGAGA GAGGGGCATC CCTCCACCTG GACTTGGTCA
GAAGATTTAT GAAATAGACC 780

204370454500F

CCCTTTTGAC AAACATCGT CAACACCTTG ATTACAGGTA TTCACAGTAC
AAGAAAATGA 840

GGGAGGCAAT TGACAAGTAT GAGGGTGGTT TGGAAGCTTT
TTCTCGTGGT TATGAAAAAA 900

TGGGTTTCAC TCGTAGTGCT ACAGGTATCA CTTACCGTGA GTGGGCTCCT
GGTGCCCAGT 960

CAGCTGCTCT CATTGGAGAT TTCAACAATT GGGACGCAA TGCTGACATT
ATGACTCGGA 1020

ATGAATTTGG TGTCTGGGAG ATTTTCTGC CAAATAATGT GGATGGTTCT
CCTGCAATTC 1080

CTCATGGGTC CAGAGTGAAG ATACGCATGG ACACTTCATC
AGGTGTTAAG GATTCCATTC 1140

CTGCTTGGAT CAACTACTCT TTACAGCTTC CTGATGAAAT TCCATATAAT
GGAATATATT 1200

ATGATCCACC CGAAGAGGAG AGGTATGTCT TCCAACACCC
ACGGCCAAAG AAACCAAAGT 1260

CGCTGAGAAT ATATGAATCT CATATTGGAA TGAGTAGTCC GGAGCCTAAA
ATTAATCAT 1320

ACGTGAATTT TAGAGATGAA GTTCTTCCTC GCATAAAAAA CCTTGGGTAC
AATGCGGTGC 1380

AAATTATGGC TATTCAAGAG CATTCTTATT ATGCTAGTTT TGGTTATCAT
GTCACAAATT 1440

TTTTTGCACC AAGCAGCCGT TTTGGAACGC CCGACGACCT TAAGTCTTTG
ATTGATAAAG 1500

CTCATGAGCT AGGAATTGTT GTTCTCATGG ACATTGTTCA CAGCCATGCA
TCAAATAATA 1560

CTTTAGATGG ACTGAACATG TTTGACGGCA CAGATAGTTG TTA CTTTCAC
TCTGGAGCTC 1620

GTGGTTATCA TTGGATGTGG GATTCCCGCC TCTTTAACTA TGGAAACTGG
GAGGTACTTA 1680

GGTATCTTCT CTCAAATGCG AGATGGTGGT TGGATGAGTG CAAATTTGRT
GGATTTAGAT 1740

TTGATGGTGT GACATCAATG ATGTATACTC ACCACGGATT ATCGGTGGGA
TTCAGTGGGA 1800

ACTACGAGGA ATACTTTGGA CTCGCAACTG ATGTRGATGC TGCCGTGTAT
CTGATGCTGG 1860

CCAACGATCT TATTCATGGG CTTTTCCCAG ATGCAATTAC CATTGGTGAA
GATGTTAGCG 1920

GAATGCCGAC ATTTTGTATT CCCGTTCAAG ATGGGGGTGT TGGCTTTGAC
TATCGGCTGC 1980

ATATGGCAAT TGCTGATAAA TGGATTGAGT TGCTCAAGAA ACGGGATGAG
GATTGGAGAG 2040

TGGGTGATAT TGTTCATACA CTGACAAATA GAAGATGGTC GGAAAAGTGT
GTTTCATACG 2100

CTGAAAGTCA TGATCAAGCT CTAGTCGGTG ATAAACTAT AGCATTCTGG
CTGATGGACA 2160

AGGATATGTA TGATTTTATG GCTTTGGATA GACCGTCAAC ATCATTATA
GATCGTGGGA 2220

TAGCATTGCA CAAGATGATT AGGCTTGTA CTATGGGATT AGGAGGAGAA
GGGTACCTAA 2280

ATTCATGGG AAATGAATTC GGCCACCCTG AGTGGATTGA TTTCCCTAGG
GCTGAACAAC 2340

ACCTCTCTGA TGGCTCAGTA ATTCCCGGAA ACCAATTCAG TTATGATAAA
TGCAGACGGA 2400

GATTTGACCT GGGAGATGCA GAATATTAA GATACCGTGG GTTGCAAGAA
TTTGACCGGG 2460

CTATGCAGTA TCTTGAAGAT AAATATGAGT TTATGACTTC AGAACACCAG
TTCATATCAC 2520

GAAAGGATGA AGGAGATAGG ATGATTGTAT TTGAAAAGG AAACCTAGTT
TTTGTCTTA 2580

ATTTTCACTG GACAAAAAGC TATTCAGACT ATCGCATAGG CTGGCTGAAG
CCTGGAAAAT 2640

ACAAGGTTGC CTTGGACTCA GATGATCCAC TTTTGGTGG
CTTCGGGAGA ATTGATCATA 2700

ATGCCGAATG TTTACCTTT GAAGGATGGT ATGATGATCG TCCTCGTTCA
ATTATGGTGT 2760

ATGCACCTAG TAGAACAGCA GTGGTCTATG CACTAGTAGA CAAAGAAGAA
GAAGAAGAAG 2820

AAGTAGCAGT AGTAGAAGAA GTAGTAGTAG AAGAAGAATG AACGAACTTG
TGATCGCGTT 2880

GAAAGATTTG AACGCTACAT AGAGCTTCTT GACGTATCTG GCAATATTGC
ATCAGTCTTG 2940

GCGGAATTTT ATGTGACAAA AGGTTTGCAA TTCTTTCCAC TATTAGTAGT
GCAACGATAT 3000

ACGCAGAGAT GAAGTGCTGA ACAAACATAT GTAAAATCGA TGAATTTATG
TCGAATGCTG 3060

GGACGGGCTT CAGCAGGTTT TGCTTAGTGA GTTCTGTAAA TTGTCATCTC
TTTANATGTA 3120

CAGCCCACTA GAAATCAATT ATGTGAGACC TAAAAAACAA TAACCATAAA
ATGGAAATAG 3180

TGCTGATCTA ATGATGTTTT AANCCNNNNA AAAAAAAAAA AAAAACTCGA
G 3231

(2) INFORMATION FOR SEQ ID NO: 19:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2578 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 19:

TCATTAAAGA GGAGAAATTA ACTATGAGAG GATCTCACCA TCACCATCAC
CATGGGATCT 60

TGGCTGAAAA GTCTTCTTAC AATTCCGAAT TCCGACCTTC TACAGTTGCA
GCATCGGGGA 120

AAGTCCTTGT GCCTGGAACC CAGAGTGATA GCTCCTCATC CTCAACAAAC
CAATTTGAGT 180

TCACTGAGAC ATCTCCAGAA AATTCCCCAG CATCAACTGA TGTAGATAGT
TCAACAATGG 240

AACACGCTAG CCAGATTAAA ACTGAGAACG ATGACGTTGA
GCCGTCAAGT GATCTTACAG 300

GAAGTGTTGA AGAGCTGGAT TTTGCTTCAT CACTACAACT ACAAGAAGGT
GGTAAACTGG 360

AGGAGTCTAA AACATTAAAT ACTTCTGAAG AGACAATTAT TGATGAATCT
GATAGGATCA 420

GAGAGAGGGG CATCCCTCCA CCTGGACTTG GTCAGAAGAT
TTATGAAATA GACCCCTTT 480

TGACAAACTA TCGTCAACAC CTTGATTACA GGTATTCACA GTACAAGAAA
CTGAGGGAGG 540

CAATTGACAA GTATGAGGGT GGT TTGGAAG CTTTTTCTCG TGGTTATGAA
AAAATGGGTT 600

TCACTCGTAG TGCTACAGGT ATCACTTACC GTGAGTGGGC
TCCTGGTGCC CAGTCAGCTG 660

CCCTCATTGG AGATTTCAAC AATTGGGACG CAAATGCTGA CATTATGACT
CGGAATGAAT 720

TTGGTGTCTG GGAGATTTTT CTGCCAAATA ATGTGGATGG TTCTCCTGCA
ATTCCTCATG 780

GGTCCAGAGT GAAGATACGT ATGGACACTC CATCAGGTGT
TAAGGATTCC ATTCCTGCTT 840

GGATCAACTA CTCTTCACAG CTTCTGATG AAATTCCATA TAATGGAATA
TATTATGATC 900

CACCCGAAGA GGAGAGGTAT ATCTTCCAAC ACCCACGGCC
AAAGAAACCA AAGTCGCTGA 960

GAATATATGA ATCTCATATT GGAATGAGTA GTCCGGAGCC TAAAATTAAC
TCATACGTGA 1020

ATTTTAGAGA TGAAGTTCTT CCTCGCATAA AAAAGCTTGG GTACAATGCG
GTGCAAATTA 1080

TGGCTATTCA AGAGCATTCT TATTATGCTA GTTTTGGTTA TCATGTCACA
AATTTTTTTG 1140

CACCAAGCAG CCGTTTTGGA ACGCCCGACG ACCTTAAGTC TTTGATTGAT
AAAGCTCATG 1200

AGCTAGGAAT TGTTGTTCTC ATGGACATTG TTCACAGCCA TGCATCAAAT
AATACTTTAG 1260

ATGGACTGAA CATGTTTGAC GGCACCGATA GTTGTTACTT TCACTCTGGA
GCTCGTGGTT 1320

ATCATTGGAT GTGGGATTCC CGCCTTTTTA ACTATGGAAA CTGGGAGGTA
CTTAGGTATC 1380

TTCTCTCAA TCGAGATGG TGGTTGGATG AGTTCAAATT TGATGGATT
AGATTTGATG 1440

GTGTGACATC AATGATGTAT ACTCACCACG GATTATCGGT GGGATTCACT
GGGAACACG 1500

AGGAATACTT TGGACTCGCA ACTGATGTGG ATGCTGTTGT GTATCTGATG
CTGGTCAACG 1560

ATCTTATTCA TGGGCTTTTC CCAGATGCAA TTACCATTGG TGAAGATGTT
AGCGGAATGC 1620

CGACATTTTG TATTCCCGTT CAAGATGGGG GTGTTGGCTT TGACTATCGG
CTGCATATGG 1680

CAATTGCTGA TAAATGGATT GAGTTGCTCA AGAAACGGGA TGAGGATTGG
AGAGTGGGTG 1740

ATATTGTTCA TACACTGACA AATAGAAGAT GGTCGGAAAA GTGTGTTTCA
TACGCTGAAA 1800

20437045401402

GTCATGATCA AGCTCTAGTC GGTGATAAAA CTATAGCATT CTGGCTGATG
GACAAGGATA 1860

TGTATGATTT TATGGCTCTG GATAGACCGC CAACATCATT AATAGATCGT
GGGATAGCAT 1920

TGCACAAGAT GATTAGGCTT GTAACCTATGG GATTAGGAGG
AGAAGGGTAC CTAAATTTCA 1980

TGGGAAATGA ATTCGGCCAC CCTGAGTGGA TTGATTTCCC
TAGGGCTGAA CAACACCTCT 2040

CTGATGACTC AGTAATTCCC GGAAACCAAT TCAGTTATGA TAAATGCAGA
CGGAGATTTG 2100

ACCTGGGAGA TGCAGAATAT TTAAGATACC GTGGGTTGCA AGAATTTGAC
CGGGCTATGC 2160

AGTATCTTGA AGATAAATAT GAGTTTATGA CTCAGAACA CCAGTTCATA
TCACGAAAGG 2220

ATGAAGGAGA TAGGATGATT GTATTTGAAA AAGGAAACCT AGTTTTTGTC
TTTAATTTTC 2280

ACTGGACAAA AAGCTATTCA GACTATCGCA TAGGCTGCCT
GAAGCCTGGA AAATACAAGG 2340

TTGCCTTGGA CTCAGATGAT CCACTTTTTG GTGGCTTCGG GAGAATTGAT
CATAATGCCG 2400

AATATTTTAC CTTTGAAGGA TGGTATGATG ATCGTCCTCG TTCAATTATG
GTGTATGCAC 2460

CTTGTAGAAC AGCAGTGGTC TATGCACTAG TAGACAAAGA AGAAGAAGAA
GAAGAAGAAG 2520

AAGAAGAAGT AGCAGTAGTA GAAGAAGTAG TAGTAGAAGA
AGAATGAACG AACTTGTG 2578

(2) INFORMATION FOR SEQ ID NO: 20:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 23 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 20:

AATTYYATGG GNAAYGARTT YGG

23

2023-01-04 10:54:43

SEQUENCE LISTING

(1) GENERAL INFORMATION:

(i) APPLICANTS:

- (A) Cooke, David
- (B) Debet, Martine
- (C) Gidley, Micheal John
- (D) Jobling, Stephen Alan
- (E) Safford, Richard
- (F) Sidebottom, Christopher Michael
- (G) Westcott, Roger John

(ii) TITLE OF INVENTION: Improvements in or Relating to Plant Starch Composition

(iii) NUMBER OF SEQUENCES: 20

(iv) CORRESPONDANCE ADDRESS:

- (A) NAME: National Starch and Chemical Company
- (B) STREET: 10 Finderne Avenue, P.O. Box 6500
- (C) CITY: Bridgewater
- (D) STATE: New Jersey
- (E) COUNTRY: United States
- (F) ZIP CODE: 08807-500

(v) COMPUTER READABLE FORM:

- (A) MEDIUM TYPE: IMB 1.44 MB High Density Diskette
- (B) COMPUTER: COMPAQ Deskpro 590 (IBM PC compatible)
- (C) OPERATING SYSTEM: WINDOWS 95
- (D) SOFTWARE: Word 7.0 for Windows

(vi) CURRENT APPLICATION DATA:

- (A) APPLICATION NUMBER:
- (B) FILING DATE: Filed concurrently herewith
- (C) CLASSIFICATION

(vii) PRIOR APPLICATION DATA

- (A) APPLICATION NUMBER: PCT/GB96/01075
- (B) INTERNATIONAL FILING DATE: May 3, 1996
- (C) PRIORITY DATE: May 5, 1995

(viii) ATTORNEY INFORMATION

- (A) NAME: Karen G. Kaiser
- (B) REGISTRATION NO: 33,506
- (C) DOCKET NUMBER: 1627

(ix) TELECOMMUNICATION INFORMATION

- (A) TELEPHONE: (908) 575-6152
- (B) FACSIMILE: (908) 707-3706
- (C) E-MAIL: KAREN.KAISER@NSTARCH.COM

(2) INFORMATION FOR SEQ ID NO: 1:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 57 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 1:

AAGGATCCGT CGACATCGAT AATACGACTC ACTATAGGGA TTTT TTTT TTTT

57

(2) INFORMATION FOR SEQ ID NO: 2:

10056454-012402

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 17 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 2:

AAGGATCCGT CGACATC

17

(2) INFORMATION FOR SEQ ID NO: 3:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 17 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 3:

GACATCGATA ATACGAC

17

(2) INFORMATION FOR SEQ ID NO: 4:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 20 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 4:

CATCCAACCA CCATCTCGCA

20

(2) INFORMATION FOR SEQ ID NO: 5:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 20 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 5:

TTGAGAGAAG ATACCTAAGT

20

(2) INFORMATION FOR SEQ ID NO: 6:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 20 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 6:

ATGTTCAAGTC CATCTAAAGT

20

(2) INFORMATION FOR SEQ ID NO: 7:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 20 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 7:

AGAACAACAA TTCCTAGCTC

20

(2) INFORMATION FOR SEQ ID NO: 8:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 20 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 8:

GGGGCCTTGA ACTCAGCAAT

20

(2) INFORMATION FOR SEQ ID NO: 9:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 20 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 9:

CGTCCCAGCA TTCGACATAA

20

(2) INFORMATION FOR SEQ ID NO: 10:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 26 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 10:

CTTGGATCCT TGAAGTCAGC AATTTG

26

(2) INFORMATION FOR SEQ ID NO: 11:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 29 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 11:

TAACTCGAGC AACGCGATCA CAAGTTCGT

29

202504151056454.013402

(2) INFORMATION FOR SEQ ID NO: 12:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 3003 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 12:

GATGGGGCCT TGAACTCAGC AATTTGACAC TCAGTTAGTT ACACTGCCAT CACTTATCAG	60
ATCTCTATTT TTTCTCTTAA TTCCAACCAA GGAATGAATA AAAAGATAGA TTTGTAAAAA	120
CCCTAAGGAG AGAAGAAGAA AGATGGTGTA TACACTCTCT GGAGTTCGTT TTCCTACTGT	180
TCCATCAGTG TACAAATCTA ATGGATTGAG CAGTAATGGT GATCGGAGGA ATGCTAATAT	240
TTCTGTATTC TTGAAAAAAC ACTCTCTTTC ACGGAAGATC TTGGCTGAAA AGTCTTCTTA	300
CAATTCCGAA TCCCGACCTT CTACAATTGC AGCATCGGGG AAAGTCCTTG TGCCTGGAAT	360
CCAGAGTGAT AGCTCCTCAT CCTCAACAGA TCAATTTGAG TTCGCTGAGA CATCTCCAGA	420
AAATTCCTCA GCATCAACTG ATGTAGATAG TTCAACAATG GAACACGCTA GCCAGATTAA	480
AACTGAGAAC GATGACGTTG AGCCGTCAAG TGATCTTACA GGAAGTGTTG AAGAGCTGGA	540
TTTTTGCTTCA TCACTACAAC TACAAGAAGG TGGTAAACTG GAGGAGTCTA AAACATTAAA	600
TACTTCTGAA GAGACAATTA TTGATGAATC TGATAGGATC AGAGAGAGGG GCATCCCTCC	660
ACCTGGACTT GGTGAGAAGA TTTATGAAAT AGACCCCTT TTGACAACT ATCGTCAACA	720
CCTTGATTAC AGGTATTCAC AGTACAAGAA ACTGAGGGAG GCAATTGACA AGTATGAGGG	780
TGGTTTGGA GCTTTTTCTC GTGGTTATGA AAGAATGGGT TTCACTCGTA GTGCTACAGG	840
TATCACTTAC CGTGAGTGGG CTCCTGGTGC CCAGTCAGCT GCCCTCATTG GGGATTTCAA	900
CAATGGGGAC GCAAAATGCTG ACTTTATGAC TCGGAATGAA TTTGGTGTCT GAGAGATTTT	960
TCTGCCAAAT AATGTGGATG GTTCTCCTGC AATTCCTCAT GGGTCCAGAG TGAAGATACG	1020
TATGGACACT CCATCAGGTG TTAAGGATTC CATTCTGCT TGGATCAACT ACTCTTTACA	1080
GCTTCCTGAT GAAATTCCAT ATAATGGAAT ATATTATGAT CCACCCGAAG AGGAGAGGTA	1140
TATCTTCCAA CACCCACGGC CAAAGAAACC AAAGTCGGTG AGAATATATG AATCTCATAT	1200
TGGAATGAGT AGTCCGGAGC CTAATAATTAA CTCATACGTG AATTTTAGAG ATGAAGTTCT	1260
TCCTCGCATA AAAAAAGCTT GGGTACAATG CGGTGCAAAT TATGGCTATT CAAGAGCATT	1320
CTTATTATGC TAGTTTTGGT TATCATGTCA CAAATTTTTT TGCACCAAGC AGCCGTTTTG	1380
GAACGCCCCG CGACCTTAAG TCTTTGATTG ATAAAGCTCA TGAGCTAGGA ATTGTTGTTC	1440
TCATGGACAT TGTTACAGC CATGCATCAA ATAATACTTT AGATGGACTG AACATGTTTG	1500
ACGGCACAGA TAGTTGTTAC TTTCCTCTG GAGCTCGTGG TTATCATTGG ATGTGGGATT	1560

TCCGCCTCTT TAACTATGGA AACTGGGAGG TACTTAGGTA TCTTCTCTCA AATGCGAGAT 1620
 GGTGGTTGGA TGAGTTCAAA TTTGATGGAT TTAGATTGTA TGGTGTGACA TCAATGATGT 1680
 GTACTACCA CGGATTATCG GTGGGATTCA CTGGGAAC TA CGAGGAATAC TTTGGACTCG 1740
 CAACTGATGT GGATGCTGTT GTGTATCTGA TGCTGGTCAA CGATCTTATT CATGGGCTTT 1800
 TCCCAGATGC AATTACCATT GGTGAAGATG TTAGCGGAAT GCCGACATTT TGTGTTCCCG 1860
 TTCAAGATGG GGGTGTGGC TTTGACTATC GGCTGCATAT GGCAATTGCT GATAAATGGA 1920
 TTGAGTTGCT CAAGAAACGG GATGAGGATT GGAGAGTGGG TGATATTGTT CATACACTGA 1980
 CAAATAGAAG ATGGTCGGAA AAGTGTGTTT CATACGCTGA AAGTCATGAT CAAGCTCTAG 2040
 TCGGTGATAA AACTATAGCA TTCTGGCTGA TGGACAAGGA TATGTATGAT TTTATGGCTC 2100
 TGGATAGACC GTCAACATCA TTAATAGATC GTGGGATAGC ATTACACAAG ATGATTAGGC 2160
 TTGTAACAT GGGATTAGGA GGAGAAGGGT ACCTAAATTT CATGGGAAAT GAATTCGGCC 2220
 ACCCTGAGTG GATTGATTC CCTAGGGCTG AACAAACCT CTCTGATGGC TCAGTAATTC 2280
 CCAGAAACCA ATTCAGTTAT GATAAATGCA GACGGAGATT TGACCTGGGA GATGCAGAAT 2340
 ATTTAAGATA CCGTGGGTTG CAAGAATTTG ACCGGGCTAT GCAGTATCTT GAAGATAAAT 2400
 ATGAGTTTAT GACTTCAGAA CACCAGTTCA TATCACGAAA GGATGAAGGA GATAGGATGA 2460
 TTGTATTTGA AAAAGGAAAC CTAGTTTTTG TCTTTAATTT TCACTGGACA AAAGGCTATT 2520
 CAGACTATCG CATAGGCTGC CTGAAGCCTG GAAAATACAA GGTTGCCTTG GACTCAGATG 2580
 ATCCACTTTT TGGTGGCTTC GGGAGAATTG ATCATAATGC CGAATATTTT ACCTTTGAAG 2640
 GATGGTATGA TGATCGTCCT CGTTCAATTA TGGTGTATGC ACCTAGTAGA ACAGCAGTGG 2700
 TCTATGCACT AGTAGACAAA GAAGAAGAAG AAGAAGAAGA AGTAGCAGTA GTAGAAGAAG 2760
 TAGTAGTAGA AGAAGAATGA ACGAACTTGT GATCGCGTTG AAAGATTTGA ACGCCACATA 2820
 GAGCTTCTTG ACGTATCTGG CAATATTGCA TTAGTCTTGG CGGAATTTCA TGTGACAACA 2880
 GGTTTGCAAT TCTTTCCACT ATTAGTAGTG CAACGATATA CGCAGAGATG AAGTGCTGAA 2940
 CAAAAACATA TGTAAAATCG ATGAATTTAT GTCGAATGCT GGGACGATCG AATTCCTGCA 3000
 GCC 3003

(2) INFORMATION FOR SEQ ID NO: 13:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2975 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 13:

TTGATGGGCC TTGAACTCAG CAATTTGACA CTCAGTTAGT TACACTCCTA TCACTTATCA 60
 GATCTCTATT TTTTCTCTTA ATTCCAACCA GGGGAATGAA TAAAAGGATA GATTTGTAAA 120

AACCCCTAAGG AGAGAAGAAG AAAGATGGTG TATATACTCT CTGGAGTTCTG TTTTCCTACT 180
GTTCCATCAG TGTACAAATC TAATGGATTC AGCAGTAATG GTGATCGGAG GAATGCTAAT 240
GTTTCTGTAT TCTTGAAAAA GCACTCTCTT TCACGGAAGA TCTTGGCTGA AAAGTCTTCT 300
TACAATTCCG AATTCCGACC TTCTACAGTT GCAGCATCGG GGAAAGTCCT TGTGCCTGGA 360
ACCCAGAGTG ATAGCTCCTC ATCCTCAACA GACCAATTTG AGTTCACTGA GACATCTCCA 420
GAAAATTCCC CAGCATCAAC TGATGTAGAT AGTTCAACAA TGGAACACGC TAGCCAGATT 480
AAAAGTGAAG ACGATGACGT TGAGCCGTC AAGTATCTTA CAGGAAGTGT TGAAGAGCTG 540
GATTTTGCTT CATCACTACA ACTACAAGAA GGTGGTAAAC TGGAGGAGTC TAAAACATTA 600
AATACTTCTG AAGAGACAAT TATTGATGAA TCTGATAGGA TCAGAGAGAG GGGCATCCCT 660
CCACCTGGAC TTGGTCAGAA GATTTATGAA ATAGACCCCC TTTTGACAAA CTATCGTCAA 720
CACCTTGATT ACAGGTATTC ACAGTACAAG AAAGTGAAGG AGGCAATTGA CAAGTATGAG 780
GGTGGTTTGG AAGCTTTTCT CGTGGTTATG AAAAAATGGG TTCTACTCGT AGTGCTACAG 840
GTATCACTTA CCGTGAGTGG GCTCCTGGTG CCCAGTCAGC TGCCCTCATT GGAGATTTCA 900
ACAATTGGGA CGCAAATGCT GACATTATGA CTCGGAATGA ATTTGGTGTC TGGGAGATTT 960
TTCTGCCAAA TAATGTGGAT GGTTCCTCTG CAATTCCTCA TGGGTCCAGA GTGAAGATAC 1020
GTATGGACAC TCCATCAGGT GTTAAGGATT CCATTCCTGC TTGGATCAAC TACTCTTTAC 1080
AGCTTCCTGA TGAAATTCCA TATAATGGAA TATATTATGA TCCACCCGAA GAGGAGAGGT 1140
ATATCTTCCA ACACCCACGG CCAAAGAAAC CAAAGTCGCT GAGAATATAT GAATCTCATA 1200
TTGGAATGAG TAGTCCGGAG CCTAAAATTA ACTCATACGT GAATTTTAGA GATGAAGTTC 1260
TTCCTCGCAT AAAAAAGCTT GGGTACAATG CGCTGCGAAT TATGGCTATT CAAGAGCATT 1320
CTTATTATGC TAGTTTTGGT TATCATGTCA CAAATTTTTT TGCACCAAGC AGCCGTTTTG 1380
GAACGCCCCG CGACCTTAAG TCTTCGATTG ATAAAGCTCA TGAGCTAGGA ATTGTTGTTC 1440
TCATGGACAT CGTTCACAGC CATGCATCAA ATAATACTTT AGATGGACTG AACATGTTTG 1500
ACGGCACCGA TAGTTGTTAC TTCTACTCTG GAGCTCGTGG TTATCATTTG ATGTGGGATT 1560
CCGCCTCTTT AACTATGGAA ACTGGGAGGT ACTTAGGTAT CTTCTCTCAA ATGCGAGATG 1620
GTGGTTGGAT GAGTTCAAAT TTGATGGATT TAGATTGAT GGTGTGACAT CAATGATGTA 1680
TACTCACCAC GGATTATCGG TGGGATTCAC TGGGAACAC GAGGAATACT TTGGACTCGC 1740
AACTGATGTG GATGCTGTTG TGTATCTGAT GCTGGTCAAC GATCTTATTC ATAGGCTTTT 1800
CCCAGATGCA ATTACCATTT GTGAAGATGT TAGCGGAATG CCGACATTTT GTATTCCCGT 1860
TCAAGATGGG GGTGTTGGCT TTGACTATCG GCTGCATATG GCAATTGCTG ATAAATGGAT 1920
TGAGTTGCTC AAGAAACGGG ATGAGGATTG GAGAGTGGGT GATATTGTTC ATACACTGAC 1980

AAATAGAAGA TGGTCGGAAA AGTGTGTTTC ATACGCTGAA AGTCATGATC AAGCTCTAGT 2040
 CGGTGATAAA ACTATAGCAT TCTGGCTGAT GGACAAGGAT ATGTATGATT TTATGGCTCT 2100
 GGATAGACCG CCAACATCAT TAATAGATCG TGGGATAGCA TTGCACAAGA TGATTAGGCT 2160
 TGTAACATATG GGATTAGGAG GAGAAGGGTA CCTAAATTTT ATGGGAAATG AATTCGGCCA 2220
 CCCTGAGTGG ATTGATTTCC CTAGGGCTGA GCCACACCTT TCTGATGGCT CAGTAATTCC 2280
 CGGAAACCAA TTCAGTTATG ATAAATGCAG ACGGAGATTG GACCTGGGAG ATGCAGAATA 2340
 TTTAAGATAC CATGGGTAC AAGAATTTGA CTGGGCTATG CAGTATCTTG AAGATAAATA 2400
 TGAGTTTATG ACTTCAGAAC ACCAGTTCAT ATCACGAAAG GATGAAGGAG ATAGGATGAT 2460
 TGTATTTGAA AGAGGAAACC TAGTTTTTCGT CTTTAATTTT CACTGGACAA ATAGCTATTC 2520
 AGACTATCGC ATAGGCTGCC TGAAGCCTGG AAAATACAAG GTTGTCTTGG ACTCAGATGA 2580
 TCCACTTTTTT GGTGGCTTCG GGAGAATTGA TCATAATGCC GAATATTTCA CCTCTGAAGG 2640
 ATCGTATGAT GATCGTCCTT GTTCAATTAT GGTGTATGCA CCTAGTAGAA CAGCAGTGGT 2700
 CTATGCACTA GTAGACAAAC TAGAAGTAGC AGTAGTAGAA GAACCCATTG AAGAATGAAC 2760
 GAACCTGTGA TCGCGTTGAA AGATTTGAAC GTTACTTGGT CATCCACATA GAGCTTCTTG 2820
 ACATCAGTCT TGGCGGAATT GCATGTGACA ACAAGGTTTG CAGTTCTTTC CACTATTAGT 2880
 AGTCCACCGA TATACGCAGA GATGAAGTGC TGAACAAACA TATGTAAAAT CGATGAATTT 2940
 ATGTGCAATG CTGGGACGAT CGAATTCCTG CAGCC 2975

(2) INFORMATION FOR SEQ ID NO: 14:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 3033 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ix) FEATURE:

- (A) NAME/KEY: CDS
- (B) LOCATION: 145..2790

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 14:

TTGATGGGGC CTTGAACTCA GCAATTTGAC ACTCAGTTAG TTACACTCCT ATCACTTATC 60
 AGATCTCTAT TTTTCTCTT AATTCCAACC AAGGAATGAA TAAAAGGATA GATTGTGAAA 120
 AACCTAAGG AGAGAAGAAG AAAG ATG GTG TAT ACA CTC TCT GGA GTT CGT 171
 Met Val Tyr Thr Leu Ser Gly Val Arg
 1 5
 TTT CCT ACT GTT CCA TCA GTG TAC AAA TCT AAT GGA TTC AGC AGT AAT 219
 Phe Pro Thr Val Pro Ser Val Tyr Lys Ser Asn Gly Phe Ser Ser Asn
 10 15 20 25
 GGT GAT CGG AGG AAT GCT AAT GTT TCT GTA TTC TTG AAA AAG CAC TCT 267

Gly	Asp	Arg	Arg	Asn	Ala	Asn	Val	Ser	Val	Phe	Leu	Lys	Lys	His	Ser	
				30					35					40		
CTT	TCA	CGG	AAG	ATC	TTG	GCT	GAA	AAG	TCT	TCT	TAC	AAT	TCC	GAA	TTC	315
Leu	Ser	Arg	Lys	Ile	Leu	Ala	Glu	Lys	Ser	Ser	Tyr	Asn	Ser	Glu	Phe	
			45					50					55			
CGA	CCT	TCT	ACA	GTT	GCA	GCA	TCG	GGG	AAA	GTC	CTT	GTG	CCT	GGA	ACC	363
Arg	Pro	Ser	Thr	Val	Ala	Ala	Ser	Gly	Lys	Val	Leu	Val	Pro	Gly	Thr	
			60				65					70				
CAG	AGT	GAT	AGC	TCC	TCA	TCC	TCA	ACA	GAC	CAA	TTT	GAG	TTC	ACT	GAG	411
Gln	Ser	Asp	Ser	Ser	Ser	Ser	Ser	Thr	Asp	Gln	Phe	Glu	Phe	Thr	Glu	
	75						80				85					
ACA	TCT	CCA	GAA	AAT	TCC	CCA	GCA	TCA	ACT	GAT	GTA	GAT	AGT	TCA	ACA	459
Thr	Ser	Pro	Glu	Asn	Ser	Pro	Ala	Ser	Thr	Asp	Val	Asp	Ser	Ser	Thr	
	90				95					100					105	
ATG	GAA	CAC	GCT	AGC	CAG	ATT	AAA	ACT	GAG	AAC	GAT	GAC	GTT	GAG	CCG	507
Met	Glu	His	Ala	Ser	Gln	Ile	Lys	Thr	Glu	Asn	Asp	Asp	Val	Glu	Pro	
				110					115					120		
TCA	AGT	GAT	CTT	ACA	GGA	AGT	GTT	GAA	GAG	CTG	GAT	TTT	GCT	TCA	TCA	555
Ser	Ser	Asp	Leu	Thr	Gly	Ser	Val	Glu	Glu	Leu	Asp	Phe	Ala	Ser	Ser	
			125					130					135			
CTA	CAA	CTA	CAA	GAA	GGT	GGT	AAA	CTG	GAG	GAG	TCT	AAA	ACA	TTA	AAT	603
Leu	Gln	Leu	Gln	Glu	Gly	Gly	Lys	Leu	Glu	Glu	Ser	Lys	Thr	Leu	Asn	
			140				145					150				
ACT	TCT	GAA	GAG	ACA	ATT	ATT	GAT	GAA	TCT	GAT	AGG	ATC	AGA	GAG	AGG	651
Thr	Ser	Glu	Glu	Thr	Ile	Ile	Asp	Glu	Ser	Asp	Arg	Ile	Arg	Glu	Arg	
	155					160					165					
GGC	ATC	CCT	CCA	CCT	GGA	CTT	GGT	CAG	AAG	ATT	TAT	GAA	ATA	GAC	CCC	699
Gly	Ile	Pro	Pro	Pro	Gly	Leu	Gly	Gln	Lys	Ile	Tyr	Glu	Ile	Asp	Pro	
	170				175					180					185	
CTT	TTG	ACA	AAC	TAT	CGT	CAA	CAC	CTT	GAT	TAC	AGG	TAT	TCA	CAG	TAC	747
Leu	Leu	Thr	Asn	Tyr	Arg	Gln	His	Leu	Asp	Tyr	Arg	Tyr	Ser	Gln	Tyr	
				190					195					200		
AAG	AAA	CTG	AGG	GAG	GCA	ATT	GAC	AAG	TAT	GAG	GGT	GGT	TTG	GAA	GCC	795
Lys	Lys	Leu	Arg	Glu	Ala	Ile	Asp	Lys	Tyr	Glu	Gly	Gly	Leu	Glu	Ala	
			205					210					215			
TTT	TCT	CGT	GGT	TAT	GAA	AAA	ATG	GGT	TTC	ACT	CGT	AGT	GCT	ACA	GGT	843
Phe	Ser	Arg	Gly	Tyr	Glu	Lys	Met	Gly	Phe	Thr	Arg	Ser	Ala	Thr	Gly	
		220				225						230				
ATC	ACT	TAC	CGT	GAG	TGG	GCT	CTT	GGT	GCC	CAG	TCA	GCT	GCC	CTC	ATT	891
Ile	Thr	Tyr	Arg	Glu	Trp	Ala	Leu	Gly	Ala	Gln	Ser	Ala	Ala	Leu	Ile	
		235				240				245						
GGA	GAT	TTC	AAC	AAT	TGG	GAC	GCA	AAT	GCT	GAC	ATT	ATG	ACT	CGG	AAT	939
Gly	Asp	Phe	Asn	Asn	Trp	Asp	Ala	Asn	Ala	Asp	Ile	Met	Thr	Arg	Asn	
	250				255					260					265	
GAA	TTT	GGT	GTC	TGG	GAG	ATT	TTT	CTG	CCA	AAT	AAT	GTG	GAT	GGT	TCT	987
Glu	Phe	Gly	Val	Trp	Glu	Ile	Phe	Leu	Pro	Asn	Asn	Val	Asp	Gly	Ser	

270	275	280	
CCT GCA ATT CCT CAT GGG TCC AGA GTG AAG ATA CGT ATG GAC ACT CCA Pro Ala Ile Pro His Gly Ser Arg Val Lys Ile Arg Met Asp Thr Pro 285 290 295			1035
TCA GGT GTT AAG GAT TCC ATT CCT GCT TGG ATC AAC TAC TCT TTA CAG Ser Gly Val Lys Asp Ser Ile Pro Ala Trp Ile Asn Tyr Ser Leu Gln 300 305 310			1083
CTT CCT GAT GAA ATT CCA TAT AAT GGA ATA CAT TAT GAT CCA CCC GAA Leu Pro Asp Glu Ile Pro Tyr Asn Gly Ile His Tyr Asp Pro Pro Glu 315 320 325			1131
GAG GAG AGG TAT ATC TTC CAA CAC CCA CGG CCA AAG AAA CCA AAG TCG Glu Glu Arg Tyr Ile Phe Gln His Pro Arg Pro Lys Lys Pro Lys Ser 330 335 340 345			1179
CTG AGA ATA TAT GAA TCT CAT ATT GGA ATG AGT AGT CCG GAG CCT AAA Leu Arg Ile Tyr Glu Ser His Ile Gly Met Ser Ser Pro Glu Pro Lys 350 355 360			1227
ATT AAC TCA TAC GTG AAT TTT AGA GAT GAA GTT CTT CCT CGC ATA AAA Ile Asn Ser Tyr Val Asn Phe Arg Asp Glu Val Leu Pro Arg Ile Lys 365 370 375			1275
AAG CTT GGG TAC AAT GCG CTG CAA ATT ATG GCT ATT CAA GAG CAT TCT Lys Leu Gly Tyr Asn Ala Leu Gln Ile Met Ala Ile Gln Glu His Ser 380 385 390			1323
TAT TAC GCT AGT TTT GGT TAT CAT GTC ACA AAT TTT TTT GCA CCA AGC Tyr Tyr Ala Ser Phe Gly Tyr His Val Thr Asn Phe Phe Ala Pro Ser 395 400 405			1371
AGC CGT TTT GGA ACG CCC GAC GAC CTT AAG TCT TTG ATT GAT AAA GCT Ser Arg Phe Gly Thr Pro Asp Asp Leu Lys Ser Leu Ile Asp Lys Ala 410 415 420 425			1419
CAT GAG CTA GGA ATT GTT GTT CTC ATG GAC ATT GTT CAC AGC CAT GCA His Glu Leu Gly Ile Val Val Leu Met Asp Ile Val His Ser His Ala 430 435 440			1467
TCA AAT AAT ACT TTA GAT GGA CTG AAC ATG TTT GAC TGC ACC GAT AGT Ser Asn Asn Thr Leu Asp Gly Leu Asn Met Phe Asp Cys Thr Asp Ser 445 450 455			1515
TGT TAC TTT CAC TCT GGA GCT CGT GGT TAT CAT TGG ATG TGG GAT TCC Cys Tyr Phe His Ser Gly Ala Arg Gly Tyr His Trp Met Trp Asp Ser 460 465 470			1563
CGC CTC TTT AAC TAT GGA AAC TGG GAG GTA CTT AGG TAT CTT CTC TCA Arg Leu Phe Asn Tyr Gly Asn Trp Glu Val Leu Arg Tyr Leu Leu Ser 475 480 485			1611
AAT GCG AGA TGG TGG TTG GAT GCG TTC AAA TTT GAT GGA TTT AGA TTT Asn Ala Arg Trp Trp Leu Asp Ala Phe Lys Phe Asp Gly Phe Arg Phe 490 495 500 505			1659
GAT GGT GTG ACA TCA ATG ATG TAT ATT CAC CAC GGA TTA TCG GTG GGA Asp Gly Val Thr Ser Met Met Tyr Ile His His Gly Leu Ser Val Gly 510 515 520			1707
TTC ACT GGG AAC TAC GAG GAA TAC TTT GGA CTC GCA ACT GAT GTG GAT			1755

Phe	Thr	Gly	Asn	Tyr	Glu	Glu	Tyr	Phe	Gly	Leu	Ala	Thr	Asp	Val	Asp	
			525					530					535			
GCT	GTT	GTG	TAT	CTG	ATG	CTG	GTC	AAC	GAT	CTT	ATT	CAT	GGG	CTT	TTC	1803
Ala	Val	Val	Tyr	Leu	Met	Leu	Val	Asn	Asp	Leu	Ile	His	Gly	Leu	Phe	
		540					545					550				
CCA	GAT	GCA	ATT	ACC	ATT	GGT	GAA	GAT	GTT	AGC	GGA	ATG	CCG	ACA	TTT	1851
Pro	Asp	Ala	Ile	Thr	Ile		Glu	Asp	Val	Ser	Gly	Met	Pro	Thr	Phe	
	555					560					565					
TGT	ATT	CCC	GTC	CAA	GAG	GGG	GGT	GTT	GGC	TTT	GAC	TAT	CGG	CTG	CAT	1899
Cys	Ile	Pro	Val	Gln	Glu	Gly	Gly	Val	Gly	Phe	Asp	Tyr	Arg	Leu	His	
570					575					580					585	
ATG	GCA	ATT	GCT	GAT	AAA	CGG	ATT	GAG	TTG	CTC	AAG	AAA	CGG	GAT	GAG	1947
Met	Ala	Ile	Ala	Asp	Lys	Arg	Ile	Glu	Leu	Leu	Lys	Lys	Arg	Asp	Glu	
				590					595					600		
GAT	TGG	AGA	GTG	GGT	GAT	ATT	GTT	CAT	ACA	CTG	ACA	AAT	AGA	AGA	TGG	1995
Asp	Trp	Arg	Val	Gly	Asp	Ile	Val	His	Thr	Leu	Thr	Asn	Arg	Arg	Trp	
			605					610					615			
TCG	GAA	AAG	TGT	GTT	TCA	TAC	GCT	GAA	AGT	CAT	GAT	CAA	GCT	CTA	GTC	2043
Ser	Glu	Lys	Cys	Val	Ser	Tyr		Glu	Ser	His	Asp	Gln	Ala	Leu	Val	
		620					625					630				
GGT	GAT	AAA	ACT	ATA	GCA	TTC	TGG	CTG	ATG	GAC	AAG	GAT	ATG	TAT	GAT	2091
Gly	Asp	Lys	Thr	Ile	Ala	Phe	Trp	Leu	Met	Asp	Lys	Asp	Met	Tyr	Asp	
	635					640					645					
TTT	ATG	GCT	CTG	GAT	AGA	CCG	TCA	ACA	TCA	TTA	ATA	GAT	CGT	GGG	ATA	2139
Phe	Met	Ala	Leu	Asp	Arg	Pro	Ser	Thr	Ser	Leu	Ile	Asp	Arg	Gly	Ile	
650					655					660					665	
GCA	TTG	CAC	AAG	ATG	ATT	AGG	CTT	GTA	ACT	ATG	GGA	TTA	GGA	GGA	GAA	2187
Ala	Leu	His	Lys	Met	Ile	Arg	Leu	Val	Thr	Met	Gly	Leu	Gly	Gly	Glu	
				670					675					680		
GGG	TAC	CTA	AAT	TTC	ATG	GGA	AAT	GAA	TTC	GGC	CAC	CCT	GAG	TGG	ATT	2235
Gly	Tyr	Leu	Asn	Phe	Met	Gly	Asn	Glu	Phe	Gly	His	Pro	Glu	Trp	Ile	
			685					690					695			
GAT	TTC	CCT	AGG	GCT	GAA	CAA	CAC	CTC	TCT	GAT	GGC	TCA	GTA	ATC	CCC	2283
Asp	Phe	Pro	Arg	Ala	Glu	Gln	His	Leu	Ser	Asp	Gly	Ser	Val	Ile	Pro	
		700					705					710				
GGA	AAC	CAA	TTC	AGT	TAT	GAT	AAA	TGC	AGA	CGG	AGA	TTT	GAC	CTG	GGA	2331
Gly	Asn	Gln	Phe	Ser	Tyr	Asp	Lys	Cys	Arg	Arg	Arg	Phe	Asp	Leu	Gly	
	715					720					725					
GAT	GCA	GAA	TAT	TTA	AGA	TAC	CGT	GGG	TTG	CAA	GAA	TTT	GAC	CGG	CCT	2379
Asp	Ala	Glu	Tyr	Leu	Arg	Tyr	Arg	Gly	Leu	Gln	Glu	Phe	Asp	Arg	Pro	
730					735				740						745	
ATG	CAG	TAT	CTT	GAA	GAT	AAA	TAT	GAG	TTT	ATG	ACT	TCA	GAA	CAC	CAG	2427
Met	Gln	Tyr	Leu	Glu	Asp	Lys	Tyr	Glu	Phe	Met	Thr	Ser	Glu	His	Gln	
				750					755					760		
TTC	ATA	TCA	CGA	AAG	GAT	GAA	GGA	GAT	AGG	ATG	ATT	GTA	TTT	GAA	AAA	2475
Phe	Ile	Ser	Arg	Lys	Asp	Glu	Gly	Asp	Arg	Met	Ile	Val	Phe	Glu	Lys	
			765					770					775			

GGA AAC CTA GTT TTT GTC TTT AAT TTT CAC TGG ACA AAA AGC TAT TCA 2523
 Gly Asn Leu Val Phe Val Phe Asn Phe His Trp Thr Lys Ser Tyr Ser
 780 785 790

GAC TAT CGC ATA GCC TGC CTG AAG CCT GGA AAA TAC AAG GTT GCC TTG 2571
 Asp Tyr Arg Ile Ala Cys Leu Lys Pro Gly Lys Tyr Lys Val Ala Leu
 795 800 805

GAC TCA GAT GAT CCA CTT TTT GGT GGC TTC GGG AGA ATT GAT CAT AAT 2619
 Asp Ser Asp Asp Pro Leu Phe Gly Gly Phe Gly Arg Ile Asp His Asn
 810 815 820 825

GCC GAA TAT TTC ACC TTT GAA GGA TGG TAT GAT GAT CGT CCT CGT TCA 2667
 Ala Glu Tyr Phe Thr Phe Glu Gly Trp Tyr Asp Asp Arg Pro Arg Ser
 830 835 840

ATT ATG GTG TAT GCA CCT TGT AAA ACA GCA GTG GTC TAT GCA CTA GTA 2715
 Ile Met Val Tyr Ala Pro Cys Lys Thr Ala Val Val Tyr Ala Leu Val
 845 850 855

GAC AAA GAA GAA GAA GAA GAA GAA GAA GAA GAA GAA GAA GAA GTA GCA GCA 2763
 Asp Lys Glu Glu Glu Glu Glu Glu Glu Glu Glu Glu Glu Val Ala Ala
 860 865 870

GTA GAA GAA GTA GTA GTA GAA GAA GAA TGAACGAACT TGTGATCGCG 2810
 Val Glu Glu Val Val Val Glu Glu Glu
 875 880

TTGAAAGATT TGAACGCTAC ATAGAGCTTC TTGACGTATC TGGCAATATT GCATCAGTCT 2870

TGGCGGAATT TCATGTGACA CAAGGTTTGC AATTCTTTCC ACTATTAGTA GTGCAACGAT 2930

ATACGCAGAG ATGAAGTGCT GAACAAACAT ATGTAAAATC GATGAATTTA TGTCGAATGC 2990

TGGGACGATC GAATTCCTGC AGGCCGGGGG ACCCCTTAGT TCT 3033

(2) INFORMATION FOR SEQ ID NO: 15:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 882 amino acids
 - (B) TYPE: amino acid
 - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 15:

Met Val Tyr Thr Leu Ser Gly Val Arg Phe Pro Thr Val Pro Ser Val
 1 5 10 15

Tyr Lys Ser Asn Gly Phe Ser Ser Asn Gly Asp Arg Arg Asn Ala Asn
 20 25 30

Val Ser Val Phe Leu Lys Lys His Ser Leu Ser Arg Lys Ile Leu Ala
 35 40 45

Glu Lys Ser Ser Tyr Asn Ser Glu Phe Arg Pro Ser Thr Val Ala Ala
 50 55 60

Ser Gly Lys Val Leu Val Pro Gly Thr Gln Ser Asp Ser Ser Ser Ser
 65 70 75 80

Ser Thr Asp Gln Phe Glu Phe Thr Glu Thr Ser Pro Glu Asn Ser Pro

Ala Ser Thr Asp Val Asp Ser Ser Thr Met Glu His Ala Ser Gln Ile
 100 85 90 95
 Lys Thr Glu Asn Asp Asp Val Glu Pro Ser Ser Asp Leu Thr Gly Ser
 115 120 125
 Val Glu Glu Leu Asp Phe Ala Ser Ser Leu Gln Leu Gln Glu Gly Gly
 130 135 140
 Lys Leu Glu Glu Ser Lys Thr Leu Asn Thr Ser Glu Glu Thr Ile Ile
 145 150 155 160
 Asp Glu Ser Asp Arg Ile Arg Glu Arg Gly Ile Pro Pro Pro Gly Leu
 165 170 175
 Gly Gln Lys Ile Tyr Glu Ile Asp Pro Leu Leu Thr Asn Tyr Arg Gln
 180 185 190
 His Leu Asp Tyr Arg Tyr Ser Gln Tyr Lys Lys Leu Arg Glu Ala Ile
 195 200 205
 Asp Lys Tyr Glu Gly Gly Leu Glu Ala Phe Ser Arg Gly Tyr Glu Lys
 210 215 220
 Met Gly Phe Thr Arg Ser Ala Thr Gly Ile Thr Tyr Arg Glu Trp Ala
 225 230 235 240
 Leu Gly Ala Gln Ser Ala Ala Leu Ile Gly Asp Phe Asn Asn Trp Asp
 245 250 255
 Ala Asn Ala Asp Ile Met Thr Arg Asn Glu Phe Gly Val Trp Glu Ile
 260 265 270
 Phe Leu Pro Asn Asn Val Asp Gly Ser Pro Ala Ile Pro His Gly Ser
 275 280 285
 Arg Val Lys Ile Arg Met Asp Thr Pro Ser Gly Val Lys Asp Ser Ile
 290 295 300
 Pro Ala Trp Ile Asn Tyr Ser Leu Gln Leu Pro Asp Glu Ile Pro Tyr
 305 310 315 320
 Asn Gly Ile His Tyr Asp Pro Pro Glu Glu Glu Arg Tyr Ile Phe Gln
 325 330 335
 His Pro Arg Pro Lys Lys Pro Lys Ser Leu Arg Ile Tyr Glu Ser His
 340 345 350
 Ile Gly Met Ser Ser Pro Glu Pro Lys Ile Asn Ser Tyr Val Asn Phe
 355 360 365
 Arg Asp Glu Val Leu Pro Arg Ile Lys Lys Leu Gly Tyr Asn Ala Leu
 370 375 380
 Gln Ile Met Ala Ile Gln Glu His Ser Tyr Tyr Ala Ser Phe Gly Tyr
 385 390 395 400
 His Val Thr Asn Phe Phe Ala Pro Ser Ser Arg Phe Gly Thr Pro Asp
 405 410 415
 Asp Leu Lys Ser Leu Ile Asp Lys Ala His Glu Leu Gly Ile Val Val
 420 425 430

Leu Met Asp Ile Val His Ser His Ala Ser Asn Asn Thr Leu Asp Gly
 435 440 445
 Leu Asn Met Phe Asp Cys Thr Asp Ser Cys Tyr Phe His Ser Gly Ala
 450 455 460
 Arg Gly Tyr His Trp Met Trp Asp Ser Arg Leu Phe Asn Tyr Gly Asn
 465 470 475 480
 Trp Glu Val Leu Arg Tyr Leu Leu Ser Asn Ala Arg Trp Trp Leu Asp
 485 490 495
 Ala Phe Lys Phe Asp Gly Phe Arg Phe Asp Gly Val Thr Ser Met Met
 500 505 510
 Tyr Ile His His Gly Leu Ser Val Gly Phe Thr Gly Asn Tyr Glu Glu
 515 520 525
 Tyr Phe Gly Leu Ala Thr Asp Val Asp Ala Val Val Tyr Leu Met Leu
 530 535 540
 Val Asn Asp Leu Ile His Gly Leu Phe Pro Asp Ala Ile Thr Ile Gly
 545 550 555 560
 Glu Asp Val Ser Gly Met Pro Thr Phe Cys Ile Pro Val Gln Glu Gly
 565 570 575
 Gly Val Gly Phe Asp Tyr Arg Leu His Met Ala Ile Ala Asp Lys Arg
 580 585 590
 Ile Glu Leu Leu Lys Lys Arg Asp Glu Asp Trp Arg Val Gly Asp Ile
 595 600 605
 Val His Thr Leu Thr Asn Arg Arg Trp Ser Glu Lys Cys Val Ser Tyr
 610 615 620
 Ala Glu Ser His Asp Gln Ala Leu Val Gly Asp Lys Thr Ile Ala Phe
 625 630 635 640
 Trp Leu Met Asp Lys Asp Met Tyr Asp Phe Met Ala Leu Asp Arg Pro
 645 650 655
 Ser Thr Ser Leu Ile Asp Arg Gly Ile Ala Leu His Lys Met Ile Arg
 660 665 670
 Leu Val Thr Met Gly Leu Gly Gly Glu Gly Tyr Leu Asn Phe Met Gly
 675 680 685
 Asn Glu Phe Gly His Pro Glu Trp Ile Asp Phe Pro Arg Ala Glu Gln
 690 695 700
 His Leu Ser Asp Gly Ser Val Ile Pro Gly Asn Gln Phe Ser Tyr Asp
 705 710 715 720
 Lys Cys Arg Arg Arg Phe Asp Leu Gly Asp Ala Glu Tyr Leu Arg Tyr
 725 730 735
 Arg Gly Leu Gln Glu Phe Asp Arg Pro Met Gln Tyr Leu Glu Asp Lys
 740 745 750
 Tyr Glu Phe Met Thr Ser Glu His Gln Phe Ile Ser Arg Lys Asp Glu
 755 760 765
 Gly Asp Arg Met Ile Val Phe Glu Lys Gly Asn Leu Val Phe Val Phe

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 204370-44900F

770 775 780

Asn Phe His Trp Thr Lys Ser Tyr Ser Asp Tyr Arg Ile Ala Cys Leu
785 790 795 800

Lys Pro Gly Lys Tyr Lys Val Ala Leu Asp Ser Asp Asp Pro Leu Phe
 805 810 815

Gly Gly Phe Gly Arg Ile Asp His Asn Ala Glu Tyr Phe Thr Phe Glu
 820 825 830

Gly Trp Tyr Asp Asp Arg Pro Arg Ser Ile Met Val Tyr Ala Pro Cys
 835 840 845

Lys Thr Ala Val Val Tyr Ala Leu Val Asp Lys Glu Glu Glu Glu Glu
850 855 860

Glu Glu Glu Glu Glu Glu Val Ala Ala Val Glu Glu Val Val Val Glu
865 870 875 880

Glu Glu

(2) INFORMATION FOR SEQ ID NO: 16:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2576 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 16:

TCATTAAAGA GGAGAAATTA ACTATGAGAG GATCTCACCA TCACCATCAC CATGGGATCT	60
TGGCTGAAAA GTCTTCTTAC AATTCCGAAT TCCGACCTTC TACAGTTGCA GCATCGGGGA	120
AAGTCCTTGT GCCTGGAACC CAGAGTGATA GCTCCTCATC CTCAACAAAC CAATTTGAGT	180
TCACTGAGAC ATCTCCAGAA AATTCCCCAG CATCAACTGA TGTAGATAGT TCAACAATGG	240
AACACGCTAG CCAGATTAAA ACTGAGAACG ATGACGTTGA GCCGTCAAGT GATCTTACAG	300
GAAGTGTGTA AGAGCTGGAT TTTGCTTCAT CACTACAAC TACAAGAAGGT GGTAAACTGG	360
AGGAGTCTAA AACATTAAAT ACTTCTGAAG AGACAATTAT TGATGAATCT GATAGGATCA	420
GAGAGAGGGG CATCCCTCCA CCTGGACTTG GTCAGAAGAT TTATGAAATA GACCCCTTT	480
TGACAAACTA TCGTCAACAC CTTGATTACA GGTATTCACA GTACAAGAAA CTGAGGGAGG	540
CAATTGACAA GTATGAGGGT GGTGTTGGAAG CTTTTTCTCG TGGTTATGAA AAAATGGGTT	600
TCACTCGTAG TGCTACAGGT ATCACTTACC GTGAGTGGGC TCCTGGTGCC CAGTCAGCTG	660
CCCTCATTTG AGATTTC AAC AATTGGGACG CAAATGCTGA CATTATGACT CGGAATGAAT	720
TTGGTGTCTG GGAGATTTTT CTGCCAAATA ATGTGGATGG TTCTCCTGCA ATTCCTCATG	780
GGTCCAGAGT GAAGATACGT ATGGACACTC CATCAGGTGT TAAGGATTCC ATTCCTGCTT	840
GGATCAACTA CTCTACAGCT TCCTGATGAA ATTCCATATA ATGGAATATA TTATGATCCA	900

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CCCGAAGAGG AGAGGTATAT CTTCCAACAC CCACGGCCAA AGAAACCAAA GTCGCTGAGA 960
 ATATATGAAT CTCATATTGG AATGAGTAGT CCGGAGCCTA AAATTAAC TC ATACGTGAAT 1020
 TTTAGAGATG AAGTTCTTCC TCGCATAAAA AAGCTTGGGT ACAATGCGCT GCAAATTATG 1080
 GCTATTCAAG AGCATTCCTA TTATGCTAGT TTTGGTTATC ATGTCACAAA TTTTTTTGCA 1140
 CCAAGCAGCC GTTTTGGAAC GCGGACGAC CTTAAGTCTT TGATTGATAA AGCTCATGAG 1200
 CTAGGAATTG TTGTTCTCAT GGACATTGTT CACAGCCATG CATCAAATAA TACTTTAGAT 1260
 GGACTGAACA TGTGTTGACGG CACCGATAGT TGTTACTTTC ACTCTGGAGC TCGTGGTTAT 1320
 CATTGGATGT GGGATTCCCG CCTTTTAAAC TATGGAACT GGGAGGTACT TAGGTATCTT 1380
 CTCTCAAATG CGAGATGGTG GTTGGATGAG TTCAAATTTG ATGGATTTAG ATTTGATGGT 1440
 GTGACATCAA TGATGTATAC TCACCACGGA TTATCGGTGG GATTCACTGG GAACTACGAG 1500
 GAATACTTTG GACTCGCAAC TGATGTGGAT GCTGTTGTGT ATCTGATGCT GGTCAACGAT 1560
 CTTATTCATG GGCTTTTCCC AGATGCAATT ACCATTGGTG AAGATGTTAG CGGAATGCCG 1620
 ACATTTTGTA TTCCCGTTCA AGATGGGGGT GTTGGCTTTG ACTATCGGCT GCATATGGCA 1680
 ATTGCTGATA AATGGATTGA GTTGCTCAAG AAACGGGATG AGGATTGGAG AGTGGGTGAT 1740
 ATTGTTTATA CACTGACAAA TAGAAGATGG TCGGAAAAGT GTGTTTCATA CGCTGAAAGT 1800
 CATGATCAAG CTCTAGTCGG TGATAAACT ATAGCATTCT GGCTGATGGA CAAGGATATG 1860
 TATGATTTTA TGGCTCTGGA TAGACCGCCA ACATCATTAA TAGATCGTGG GATAGCATTG 1920
 CACAAGATGA TTAGGCTTGT AACTATGGGA TTAGGAGGAG AAGGGTACCT AAATTTTCATG 1980
 GGAAATGAAT TCGGCCACCC TGAGTGGATT GATTTCCCTA GGGCTGAACA ACACCTCTCT 2040
 GATGACTCAG TAATTCCCGG AAACCAATTC AGTTATGATA AATGCAGACG GAGATTTGAC 2100
 CTGGGAGATG CAGAATATTT AAGATACCGT GGGTTGCAAG AATTTGACCG GGCTATGCAG 2160
 TATCTTGAAG ATAAATATGA GTTTATGACT TCAGAACACC AGTTCATATC ACGAAAGGAT 2220
 GAAGGAGATA GGATGATTGT ATTTGAAAAA GGAAACCTAG TTTTGTCTT TAATTTTCAC 2280
 TGGACAAAAA GCTATTCAGA CTATCGCATA GGCTGCCTGA AGCCTGGAAA ATACAAGGTT 2340
 GCCTTGGACT CAGATGATCC ACTTTTGGT GGCTTCGGGA GAATTGATCA TAATGCCGAA 2400
 TATTTACCT TTGAAGGATG GTATGATGAT CGTCCTCGTT CAATTATGGT GTATGCACCT 2460
 TGTAGAACAG CAGTGGTCTA TGCCTAGTA GACAAAGAAG AAGAAGAAGA AGAAGAAGAA 2520
 GAAGAAGTAG CAGTAGTAGA AGAAGTAGTA GTAGAAGAAG AATGAACGAA CTTGTG 2576

(2) INFORMATION FOR SEQ ID NO: 17:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 2529 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 17:

GGATGCTAAT GTTTCTGTAT TCTTGAAAAA GCACTCTCTT TCACGGAAGA TCTTGGCTGA	60
AAAGTCTTCT TACAATTCCG AATCCCGACC TTCTACAGTT GCAGCATCGG GGAAAGTCCT	120
TGTGCCTGGA AYCCAGAGTG ATAGCTCCTC ATCCTCAACA GACCAATTTG AGTTCACTGA	180
GACATCTCCA GAAAATTCCC CAGCATCAAC TGATGTAGAT AGTTCAACAA TGGAACACGC	240
TAGCCAGATT AAAACTGAGA ACGATGACGT TGAGCCGTCA AGTGATCTTA CAGGAAGTGT	300
TGAAGAGCTG GATTTTGCTT CATCACTACA ACTACAAGAA GGTGGTAAAC TGGAGGAGTC	360
TAAACATTA AATACTTCTG AAGAGACAAT TATTGATGAA TCTGATAGGA TCAGAGAGAG	420
GGGCATCCCT CCACCTGGAC TTGGTCAGAA GATTTATGAA ATAGACCCCC TTTTGACAAA	480
CTATCGTCAA CACCTTGATT ACAGGTATTC ACAGTACAAG AACTGAGGG AGGCAATTGA	540
CAAGTATGAG GGTGGTTTGG AAGCTTTTTT TCGTGGTTAT GAAAAAATGG GTTTCACTCG	600
TAGTGCTACA GGTATCACTT ACCGTGAGTG GGCTCCTGGT GCCCAGTCAG CTGCCCTCAT	660
TGGAGATTTT AACAAATGGG ACGCAAATGC TGACATTATG ACTCGGAATG AATTTGGTGT	720
CTGGGAGATT TTTCTGCCAA ATAATGTGGA TGGTTCTCCT GCAATTCCTC ATGGGTCCAG	780
AGTGAAGATA CGYATGGACA CTCCATCAGG TGTTAAGGAT TCCATTCCTG CTTGGATCAA	840
CTACTCTTTA CAGCTTCCTG ATGAAATTCC ATATAATGGA ATATATTATG ATCCACCCGA	900
AGAGGAGAGG TATRTCTTCC AACACCCACG GCCAAAGAAA CCAAAGTCGC TGAGAATATA	960
TGAATCTCAT ATTGGAATGA GTAGTCCGGA GCCTAAAATT AACTCATACG TGAATTTTAG	1020
AGATGAAGTT CTTCTCGCA TAAAAAASCT TGGGTACAAT GCGGTGCAAA TTATGGCTAT	1080
TCAAGAGCAT TCTTATTATG CTAGTTTTGG TTATCATGTC ACAAATTTTT TTGCACCAAG	1140
CAGCCGTTTT GGAACGCCCC ACGACCTTAA GTCTTTGATT GATAAAGCTC ATGAGCTAGG	1200
AATTGTTGTT CTCATGGACA TTGTTACAG CCATGCATCA AATAATACTT TAGATGGACT	1260
GAACATGTTT GACGGCACAG ATAGTTGTTA CTTTCACTCT GGAGCTCGTG GTTATCATTG	1320
GATGTGGGAT TCCCGCCTCT TTAACATATG AACTGGGAG GTACTTAGGT ATCTTCTCTC	1380
AAATGCGAGA TGGTGGTTGG ATGAGTTCAA ATTTGATGGA TTTAGATTTG ATGGTGTGAC	1440
ATCAATGATG TATACTCACC ACGGATTATC GGTGGGATTC ACTGGGAACT ACGAGGAATA	1500
CTTTGGACTC GCAACTGATG TGGATGCTGT TGTGTATCTG ATGCTGGTCA ACGATCTTAT	1560
TCACGGGCTT TTCCCAGATG CAATTACCAT TGGTGAAGAT GTTAGCGGAA TGCCGACATT	1620
TTGTATTCCC GTTCAAGATG GGGGTGTTGG CTTTGA CTAT CGGCTGCATA TGGCAATTGC	1680
TGATAAATGG ATTGAGTTGC TCAAGAAACG GGATGAGGAT TGGAGAGTGG GTGATATTGT	1740
TCATACACTG ACAAATAGAA GATGGTCGGA AAAGTGTGTT TCATMCGCTG AAAGTCATGA	1800

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TCAAGCTCTA GTCGGTGATA AAACCTATAGC ATYCTGGCTG ATGGACAAGG ATATGTATGA 1860
 TTTTATGGCT CTGGATAGAC CGYCAACAYC ATTAATAGAT CGTGGGATAG CATTGCACAA 1920
 GATGATTAGG CTTGTAACTA TGGGATTAGG AGGAGAAGGG TACCTAAATT TCATGGGAAA 1980
 TGAATTCGGC CACCCTGAGT GGATTGATTT CCCTAGGGCT GARCAACACC TCTCTGATGG 2040
 CTCAGTAATT CCCGGAACCC AATTCAGTTA TGATAAATGC AGACGGAGAT TTGACCTGGG 2100
 AGATGCAGAA TATTTAAGAT ACCATGGGTT GCAAGAATTT GACCGGGCTA TGCAGTATCT 2160
 TGAAGATAAA TATGAGTTTA TGACTTCAGA ACACCAGTTC ATATCACGAA AGGATGAAGG 2220
 AGATAGGATG ATTGTATTTG AAARAGGAAA CCTAGTTTTT GTCTTTAATT TTCACTGGAC 2280
 AAATAGCTAT TCAGACTATC GCATAGGCTG CCTGAAGCCT GGAAAATACA AGGTTGGCTT 2340
 GGACTCAGAT GATCCACTTT TTGGTGGCTT CGGGAGAATT GATCATAATG CCGAATATTT 2400
 CACCTCTGAA GGATCGTATG ATGATCGTCC TCGTTCAATT ATGGTGTATG CACCTAGTAG 2460
 AACAGCAGTG GTCTATGCAC TAGTAGACAA ANTAGAAGNA GAAGAAGAAG AAGAANCCGN 2520
 NGAAGAATT 2529

(2) INFORMATION FOR SEQ ID NO: 18:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 3231 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 18:

GATTTAATAC GACTCACTAT AGGGATTTTT TTTTTTTTTT TTTTAAAAC CTCCTCCACT 60
 CAGTCTTGGG ATCTCTCTCT CTCTTCACGC TTCTCTTGGG GCCTTGAAC CAGCAATTTG 120
 ACACTCAGTT AGTTACACTC CTATCACTCA TCAGATCTCT ATTTTTTCTC TTAATTCCAA 180
 CCAAGGAATG AATTAAAAGA TTAGATTTGA AGGAGAGAAG AAGAAAGATG GTGTATACAC 240
 TCTCTGGAGT TCGTTTTCTT ACTGTTCCAT CAGTGTACAA ATCTAATGGA TTCAGCAGTA 300
 ATGGTGATCG GAGGAATGCT AATGTTTCTG TATTCTTGAA AAAGCACTCT CTTTCACGGA 360
 AGATCTTGGC TGAAAAGTCT TCTTACGATT CCGAATCCCG ACCTTCTACA GTTGACGAT 420
 CGGGGAAAGT CCTGTACCT GGAATCCAGA GTGATAGCTC CTCATCCTCA ACAGACCAAT 480
 TTGAGTTCAC TGAGACAGCT CCAGAAAATT CCCCAGCATC AACTGATGTG GATAGTTCAA 540
 CAATGGAACA CGCTAGCCAG ATTAAACTG AGAACGATGA CGTTGAGCCG TCAAGTGATC 600
 TTACAGGAAG TGTTGAAGAG TTGGATTTTG CTTTCATCACT ACAACTACAA GAAGGTGGTA 660
 AACTGGAGGA GTCTAAAACA TTAAATACTT CTGAAGAGAC AATTATTGAT GAATCTGATA 720
 GGATCAGAGA GAGGGGCATC CCTCCACCTG GACTTGGTCA GAAGATTTAT GAAATAGACC 780

CCCTTTTGAC	AAACTATCGT	CAACACCTTG	ATTACAGGTA	TTCACAGTAC	AAGAAAATGA	840
GGGAGGCAAT	TGACAAGTAT	GAGGGTGGTT	TGGAAGCTTT	TTCTCGTGGT	TATGAAAAAA	900
TGGGTTTCAC	TCGTAGTGCT	ACAGGTATCA	CTTACCGTGA	GTGGGCTCCT	GGTGCCAGT	960
CAGCTGCTCT	CATTGGAGAT	TTCAACAATT	GGGACGCAA	TGCTGACATT	ATGACTCGGA	1020
ATGAATTTGG	TGTCTGGGAG	ATTTTCTGCT	CAAATAATGT	GGATGGTTCT	CCTGCAATTC	1080
CTCATGGGTC	CAGAGTGAAG	ATACGCATGG	ACACTTCATC	AGGTGTTAAG	GATTCCATTC	1140
CTGCTTGGAT	CAACTACTCT	TTACAGCTTC	CTGATGAAAT	TCCATATAAT	GGAATATATT	1200
ATGATCCACC	CGAAGAGGAG	AGGTATGTCT	TCCAACACCC	ACGGCCAAAG	AAACCAAAGT	1260
CGCTGAGAAT	ATATGAATCT	CATATTGGAA	TGAGTAGTCC	GGAGCCTAAA	ATTAATCAT	1320
ACGTGAATTT	TAGAGATGAA	GTTCTTCCTC	GCATAAAAA	CCTTGGGTAC	AATGCGGTGC	1380
AAATTATGGC	TATTCAAGAG	CATTCTTATT	ATGCTAGTTT	TGGTTATCAT	GTCACAAATT	1440
TTTTTGCACC	AAGCAGCCGT	TTTGGAAACG	CCGACGACCT	TAAGTCTTTG	ATTGATAAAG	1500
CTCATGAGCT	AGGAATTGTT	GTTCTCATGG	ACATTGTTCA	CAGCCATGCA	TCAAATAATA	1560
CTTTAGATGG	ACTGAACATG	TTTGACGGCA	CAGATAGTTG	TTACTTTCAC	TCTGGAGCTC	1620
GTGGTTATCA	TTGGATGTGG	GATTCCCGCC	TCTTTAACTA	TGGAACTGG	GAGGTACTTA	1680
GGTATCTTCT	CTCAAATGCG	AGATGGTGGT	TGGATGAGTG	CAAATTTGRT	GGATTTAGAT	1740
TTGATGGTGT	GACATCAATG	ATGTATACTC	ACCACGGATT	ATCGGTGGGA	TTCCTGGGA	1800
ACTACGAGGA	ATACTTTGGA	CTCGCAACTG	ATGTRGATGC	TGCCGTGTAT	CTGATGCTGG	1860
CCAACGATCT	TATTCATGGG	CTTTTCCCAG	ATGCAATTAC	CATTGGTGAA	GATGTTAGCG	1920
GAATGCCGAC	ATTTTGTATT	CCCGTTCAAG	ATGGGGGTGT	TGGCTTTGAC	TATCGGCTGC	1980
ATATGGCAAT	TGCTGATAAA	TGGATTGAGT	TGCTCAAGAA	ACGGGATGAG	GATTGGAGAG	2040
TGGGTGATAT	TGTTCATACA	CTGACAAATA	GAAGATGGTC	GGAAAAGTGT	GTTTCATACG	2100
CTGAAAGTCA	TGATCAAGCT	CTAGTCGGTG	ATAAACTAT	AGCATTCCTG	CTGATGGACA	2160
AGGATATGTA	TGATTTTATG	GCTTTGGATA	GACCGTCAAC	ATCATTAATA	GATCGTGGGA	2220
TAGCATTGCA	CAAGATGATT	AGGCTTGTA	CTATGGGATT	AGGAGGAGAA	GGGTACCTAA	2280
ATTTTCATGGG	AAATGAATTC	GGCCACCCTG	AGTGGATTGA	TTTCCCTAGG	GCTGAACAAC	2340
ACCTCTCTGA	TGGCTCAGTA	ATTCCCGGAA	ACCAATTCAG	TTATGATAAA	TGCAGACGGA	2400
GATTTGACCT	GGGAGATGCA	GAATATTTAA	GATACCGTGG	GTTGCAAGAA	TTTGACCGGG	2460
CTATGCAGTA	TCTTGAAGAT	AAATATGAGT	TTATGACTTC	AGAACACCAG	TTCATATCAC	2520
GAAAGGATGA	AGGAGATAGG	ATGATTGTAT	TTGAAAAGG	AAACCTAGTT	TTTGTCTTTA	2580
ATTTTCACTG	GACAAAAAGC	TATTCAGACT	ATCGCATAGG	CTGGCTGAAG	CCTGGAAAAT	2640
ACAAGGTTGC	CTTGGAATCA	GATGATCCAC	TTTTTGGTGG	CTTCGGGAGA	ATTGATCATA	2700

ATGCCGAATG TTTCACCTTT GAAGGATGGT ATGATGATCG TCCTCGTTCA ATTATGGTGT	2760
ATGCACCTAG TAGAACAGCA GTGGTCTATG CACTAGTAGA CAAAGAAGAA GAAGAAGAAG	2820
AAGTAGCAGT AGTAGAAGAA GTAGTAGTAG AAGAAGAATG AACGAACTTG TGATCGCGTT	2880
GAAAGATTTG AACGCTACAT AGAGCTTCTT GACGTATCTG GCAATATTGC ATCAGTCTTG	2940
GCGGAATTTT ATGTGACAAA AGGTTTGCAA TTCTTTCCAC TATTAGTAGT GCAACGATAT	3000
ACGCAGAGAT GAAGTGCTGA ACAAACATAT GTAAAATCGA TGAATTTATG TCGAATGCTG	3060
GGACGGGCTT CAGCAGGTTT TGCTTAGTGA GTTCTGTAAA TTGTCATCTC TTTANATGTA	3120
CAGCCCAC TA GAAATCAATT ATGTGAGACC TAAAAAACA TAACCATAAA ATGGAAATAG	3180
TGCTGATCTA ATGATGTTTT AANCCNNNNA AAAAAAAAAA AAAA ACTCGA G	3231

(2) INFORMATION FOR SEQ ID NO: 19:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2578 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 19:

TCATTAAAGA GGAGAAATTA ACTATGAGAG GATCTCACCA TCACCATCAC CATGGGATCT	60
TGGCTGAAAA GTCTTCTTAC AATTCCGAAT TCCGACCTTC TACAGTTGCA GCATCGGGGA	120
AAGTCCTTGT GCCTGGAACC CAGAGTGATA GCTCCTCATC CTCAACAAAC CAATTTGAGT	180
TCACTGAGAC ATCTCCAGAA AATTCCCCAG CATCAACTGA TGTAGATAGT TCAACAATGG	240
AACACGCTAG CCAGATTAAA ACTGAGAACG ATGACGTTGA GCCGTCAAGT GATCTTACAG	300
GAAGTGTTGA AGAGCTGGAT TTTGCTTCAT CACTACAAC TACAAGAAGG GTTAACTGG	360
AGGAGTCTAA AACATTAAAT ACTTCTGAAG AGACAATTAT TGATGAATCT GATAGGATCA	420
GAGAGAGGGG CATCCCTCCA CCTGGACTTG GTCAGAAGAT TTATGAAATA GACCCCTTT	480
TGACAAACTA TCGTCAACAC CTTGATTACA GGTATTACACA GTACAAGAAA CTGAGGGAGG	540
CAATTGACAA GTATGAGGGT GGT TTGGAAG CTTTTTCTCG TGGTTATGAA AAAATGGGTT	600
TCACTCGTAG TGCTACAGGT ATCACTTACC GTGAGTGGGC TCCTGGTGCC CAGTCAGCTG	660
CCCTCATTTG AGATTTC AAC AATTGGGACG CAAATGCTGA CATTATGACT CGGAATGAAT	720
TTGGTGCTG GGAGATTTTT CTGCCAAATA ATGTGGATGG TTCTCCTGCA ATTCCTCATG	780
GGTCCAGAGT GAAGATACGT ATGGACACTC CATCAGGTGT TAAGGATTCC ATTCCTGCTT	840
GGATCAACTA CTCTTCACAG CTTCTGATG AAATTCCATA TAATGGAATA TATTATGATC	900
CACCCGAAGA GGAGAGGTAT ATCTTCCAAC ACCCACGGCC AAAGAAACCA AAGTCGCTGA	960
GAATATATGA ATCTCATATT GGAATGAGTA GTCCGGAGCC TAAAATTAAC TCATACGTGA	1020

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ATTTTAGAGA TGAAGTTCTT CCTCGCATAA AAAAGCTTGG GTACAATGCG GTGCAAATTA 1080
 TGGCTATTCA AGAGCATTCT TATTATGCTA GTTTTGGTTA TCATGTCACA AATTTTTTTG 1140
 CACCAAGCAG CCGTTTTGGA ACGCCCGACG ACCTTAAGTC TTTGATTGAT AAAGCTCATG 1200
 AGCTAGGAAT TGTGTGTTCTC ATGGACATTG TTCACAGCCA TGCATCAAAT AATACTTTAG 1260
 ATGGACTGAA CATGTTTGAC GGCACCGATA GTTGTTACTT TCACTCTGGA GCTCGTGGTT 1320
 ATCATTGGAT GTGGGATTCC CGCCTTTTTA ACTATGGAAA CTGGGAGGTA CTTAGGTATC 1380
 TTCTCTCAAA TGCAGATGG TGGTTGGATG AGTTCAAATT TGATGGATTT AGATTTGATG 1440
 GTGTGACATC AATGATGTAT ACTCACCACG GATTATCGGT GGGATTCACT GGGAACTACG 1500
 AGGAATACTT TGGACTCGCA ACTGATGTGG ATGCTGTTGT GTATCTGATG CTGGTCAACG 1560
 ATCTTATTCA TGGGCTTTTC CCAGATGCAA TTACCATTGG TGAAGATGTT AGCGGAATGC 1620
 CGACATTTTG TATCCCGTT CAAGATGGGG GTGTTGGCTT TGAATATCGG CTGCATATGG 1680
 CAATTGCTGA TAAATGGATT GAGTTGCTCA AGAAACGGGA TGAGGATTGG AGAGTGGGTG 1740
 ATATTGTTCA TACACTGACA AATAGAAGAT GGTGCGAAAA GTGTGTTTCA TACGCTGAAA 1800
 GTCATGATCA AGCTCTAGTC GGTGATAAAA CTATAGCATT CTGGCTGATG GACAAGGATA 1860
 TGTATGATTT TATGGCTCTG GATAGACCGC CAACATCATT AATAGATCGT GGGATAGCAT 1920
 TGCACAAGAT GATTAGGCTT GTAACATATGG GATTAGGAGG AGAAGGGTAC CTAAATTTCA 1980
 TGGGAAATGA ATTCGGCCAC CCTGAGTGGA TTGATTTCCC TAGGGCTGAA CAACACCTCT 2040
 CTGATGACTC AGTAATTCCC GGAAACCAAT TCAGTTATGA TAAATGCAGA CGGAGATTTG 2100
 ACCTGGGAGA TGCAGAATAT TTAAGATACC GTGGGTTGCA AGAATTTGAC CGGGCTATGC 2160
 AGTATCTTGA AGATAAATAT GAGTTTATGA CTTCAGAACA CCAGTTCATA TCACGAAAGG 2220
 ATGAAGGAGA TAGGATGATT GTATTTGAAA AAGGAAACCT AGTTTTTGTG TTTAATTTTC 2280
 ACTGGACAAA AAGCTATTCA GACTATCGCA TAGGCTGCCT GAAGCCTGGA AAATACAAGG 2340
 TTGCCTTGGA CTCAGATGAT CCACTTTTTG GTGGCTTCGG GAGAATTGAT CATAATGCCG 2400
 AATATTTTCA CTTTGAAGGA TGGTATGATG ATCGTCCTCG TTCAATTATG GTGTATGCAC 2460
 CTTGTAGAAC AGCAGTGGTC TATGCACTAG TAGACAAAGA AGAAGAAGAA GAAGAAGAAG 2520
 AAGAAGAAGT AGCAGTAGTA GAAGAAGTAG TAGTAGAAGA AGAATGAACG AACTTGTG 2578

(2) INFORMATION FOR SEQ ID NO: 20:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 23 base pairs
 - (B) TYPE: nucleic acid
 - (C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 20:

AATTTYATGG GNAAYGARTT YGG

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204210-4549500F